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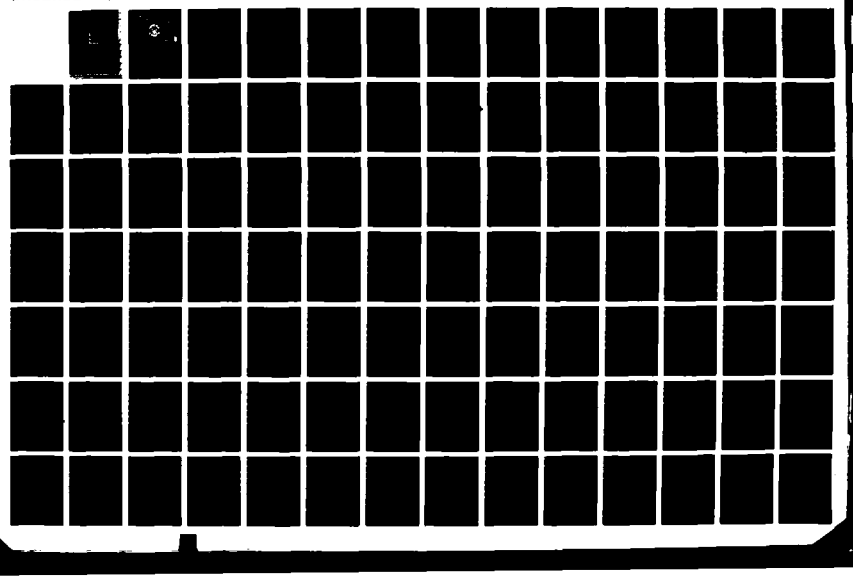

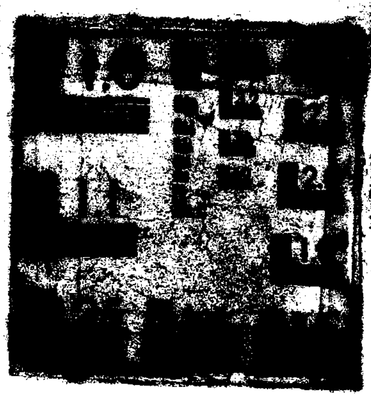

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

A STUDY OF THE CHINESE SHIPYARD MANAGEMENT CONTROL SYSTEM

by

David Michael McDonald

September 1987

Thesis Advisors: K. J. Euske
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This paper traces the evolution of the Chinese shipyard management control system. The paper starts with a presentation of the current control system in use in Chinese shipyards. Next an explanation of how this control system came to be is offered using the institutional and resource dependency perspectives of control system evolution. From 1947 until 1980 when China produced ships for domestic use only, a resource dependency perspective provides a good understanding of the shaping of the control system. When China shifted to export production in 1981, however, it is necessary to shift to an institutional perspective to present the most accurate portrayal of the control system's evolution. Finally, the paper points out that the shipbuilding organization's goals have again changed, and proposes that a resource dependency perspective best explains recent control system changes. The paper also predicts this perspective to hold for future control system development. (Keywords: thesis; quality Control; productivity).

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A Study of The Chinese Shipyard Management Control System

by

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Lieutenant, United States Navy
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ABSTRACT

This paper traces the evolution of the Chinese shipyard management control system. The paper starts with a presentation of the current control system in use in Chinese shipyards. Next an explanation of how this control system evolved is offered using the institutional and resource dependency perspectives. From 1947 until 1980 when China produced ships for domestic use only, a resource dependency perspective provides a good explanation of the shaping of the control system. When China shifted to export production in 1981, however, it is necessary to shift to an institutional perspective to present the most accurate portrayal of the control system's evolution. Finally, the paper points out that the shipbuilding organization's goals have again changed, and proposes that a resource dependency perspective best explains recent control system changes. The paper also predicts this perspective to hold for future control system development.

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I. INTRODUCTION

A. THESIS OBJECTIVE

The purpose of this research project is to study the management control system found in Chinese shipyards. Of interest is determining what control system is in place today and what factors influenced the development of the control system. The objective is to relate the formation of a specific shipyard control system to the organization's goals and the environment in which the shipyard operates. This is accomplished by looking at the evolution of the shipyard control system.

Two separate organizational theories are used to explain the evolution of the Chinese shipyard management control system: resource dependency theory and institutional theory. Before China began to build ships for export, the resource dependency model seemed to explain quite well the management control system that was in place. Once China began to sell ships in the international market, however, some significant changes occured in that control system. Why these changes occured can be explained with institutional theory.

Taken together the two theories help shed new perspective on the organization in China, explaining why it is of the form it is and indicating how this structure might be changed to function more efficiently and effectively in its environment. To the outside observer the two theories lend insight into the Chinese organizations and predict what might be expected from that organization in the future.

B. WHY CHINA?

In the forward to Bruce Swanson's book about the history of the Chinese Navy, *Eighth Voyage of the Dragon*, Ambassador Vernon Walters writes,

> A lot has been written about navies and naval warfare, but the story of the efforts of the world's oldest civilization to develop seapower is little known. The case of China is an enigma: she is a country with a vast coastline and more than three thousand offshore islands, and yet she rates only a lengthy footnote in the histories of sea power....
>
> If we in the West can know and better interpret China's long history, it will help us sift out the transitory from the lasting elements of her institutions.

In the same way that China's history at sea has been something of a mystery to us in the west, the development of organizational structures used by the Chinese has been just, and possibly more, unknown.

Although many studies (Euske and Euske, 1986 and Pfeffer and Salancik, 1978) of the development of modern organizational structure have been conducted in western countries, we do not know much about how Chinese organizations have developed. This thesis seeks an understanding of one Chinese organization, the shipyard, by looking at the evolution, or development, of that organization's control system. A study of the evolution of the control system will be useful in determining what control system is in place today and will present the factors that influenced the development of the control system. But, before going on to the Chinese shipyard, let's look more at general Chinese organizational policy.

To gain a better understanding of organizational behavior in recent Chinese history, we can make an analogy to a Chinese doll, the pu-tao-weng. The pu-tao-weng is a chinese doll that has a weighted base. When you push it in one direction it wobbles wildly back and forth , but never falls over.

Since 1949, organizational policy in China has been like the pu-tao-weng. Subjected to a wide range of forces, caused by the Chinese government rapidly changing priorities and using radical methods to achieve those priorities, the economy and policy have swung wildly back and forth.

In the past 35 years "Chinese leaders have experimented with a wide range of programs and structures, seeking at times to rationalize their bureaucracy, at other times to subject it to external supervision, and at still other times to replace it with more participatory forms of organization" (Harding, 1981, p.ix). After each revolutionary experiment, the economy staggered, only, after a few years, to reachieve equilibrium at approximately the same level it was at when the change first occured (Barnett, 1974, pp.167-171, 177-178 and Jones, 1980, p.64).

Under these unstable conditions, one may wonder how middle level management--the local bureaucracy--reacts. How do these people respond to radically changing policy direction and stay productive? Apparently, they don't. In as volatile an environment as the Chinese bureaucracy has been in the last 35 years, the emphasis has been not so much productivity as survival (Townsend, 1986, pp.337-339, 366-367, 370).

To try and answer each of the above questions on Chinese organizational structure and to try and write a complete history of Chinese organizational development is much too broad a topic for this paper, but I do hope that this paper can make a substantial start in helping the west see how the resource dependency and institutional perspectives explain the current focus of Chinese shipyard control.

C. WHY SHIPYARD MANAGEMENT?

Selecting a Chinese organization for study involved several considerations that influenced the selecting of the shipbuilding organization. Desireable characteristics included selecting an organization that has a long history, relative stability, importance to the national economy, commanded national attention, and scholarly interest. The Chinese shipbuilding industry has all of these elements.

A long history allows us to look at the organization more easily so we can explain what happened to the control system. Hence, the current control system is easier to identify. A long history can help make analyzing the organization easier because one can relate organizational changes to environmental factors and identify if there is consistency in the organization's reaction to its environment. Also, relative stability helps one collect more data to use in drawing a conclusion. Importance to the national economy means that more documentation will exist on the organization because government, business, and universities will fund more studies on the organization and greater interest will exist in effective control over the organization. The government is likely to give the organization closer attention if the organization is more important economically than other elements of society. The government also works to maintain the organization's stability providing the advantages of stability noted above.

The Chinese shipbuilding industry has been in place, in one form or another, since the eighth century, and its modern industry has been in existence since the early twentieth century (Swanson, 1982, pp.17, 130). Through China's volatile modern history: World War II, the Chinese Revolution, the Great Leap Forward, the break with the Soviet Union, the Cultural Revolution, and recent reform, the shipbuilding institutions have persevered. Through times of great social upheaval where the Chinese government, the educational institutions, and even the family unit have changed, the Chinese shipyards have continued to exist. While much rapid change occured in Chinese society and industry, the shipyards experienced a slower, more stable change (Zhang, 10 April 1987).

Shipbuilding is very important to the Chinese economy and to China's security. Not only does the shipbuilding industry employ over 300,000 workers but it also is an important consumer for many other Chinese industries, such as steel, marine equipment, motor, and generator plants (Lauriat, 1983, p.163). Additionally, the Chinese merchant marine has a great demand for ships (Muller, 1983, p.183). Any ships that can be supplied domestically greatly reduces the outflow of the limited foreign exchange that China controls. Furthermore, ships that China is able to export also boosts the important input of foreign exchange (Muller, 1983, p.184). Foreign exchange earnings are important because China funds its technology modernization program through those earnings. In recent times China has experienced a foreign exchange shortage that has caused the Chinese to cutback on foreign orders and put many contract negotiations on hold. Some have even been cancelled (Kramer, 1987, p.14). The need for foreign exchange reserves and the ability of shipbuilding to provide these earnings makes the shipbuilding industry one of China's most important industries.

Equally important as the economic benefits of the shipbuilding industry are the defense benefits. As China's merchant marine force expands and becomes increasingly important to the national economy, China's need for a navy that can protect and support this merchant marine force increases (Muller, 1983, p.236). As well, China has a major interest in consolidating seaward irredentist territories: Taiwan and the South China Sea Islands. China also has a major coast to defend (Muller, 1983, p.236). The ability to produce the ships to support a modern navy will have a major effect on China's ability to realize these goals. For these reasons, too, China's shipbuilding industry carries significant national interest.

Other reasons that make shipbuilding a worthwhile area for study include the maturity of the industry in the west which provides a good basis for comparison and the fact that the China State Shipbuilding Corporation (CSSC) is a national corporation. Being a national corporation means the corporation encompasses the entire industry, yet allows individual units (shipyards) to be studied. In other words, the smallest organizational issues are offered on a large scale. Additionally, shipbuilding provides a representation of all heavy industry in a developing country like China--the problems, management style, labor issues, competition for resources, and the other issues that all heavy industry in China must face. Finally, shipbuilding management is a particularly appropriate topic for a naval officer pursuing a master's degree in financial management.

II. RESEARCH METHOD

This study describes the extent to which the management control system developed in Chinese shipyards can be explained by either the resource dependency or the institutional theory. The focus is on the organization. The theories are tools to use in studying the organization.

A good way to look at the application of these theories to Chinese shipbuilding is to think of trying to model organizational behavior. Using either or both of these theories to explain what is happening within the organization should lead to a better understanding of the organization. We want to know what drives the Chinese shipyard control system; how is it motivated; what are the organizational goals and objectives; how does it react to stimuli; and how can it be made more efficient/effective. A better understanding of the Chinese shipyard control system organization has three immediate applications:

First, it will allow us to better cope with China as a competitor in the world shipbuilding market and in associated industries.

Second, it will allow us to assist China in the development of a critical industry. Helping China develop is consistent with the U.S. policy of improving our relations with her. Better relations with China helps establish her position as a hedge against Soviet power as well as a potentially profitable trading partner.

Third, a model or theory that can give China insight into the shaping and direction of its organization is a powerful tool for use in future planning. In recent history much of what China has done in the way of industrial/organizational development can be described as reactionary. This reactionary approach has hurt China's economic and social development (Yuan, 1973). If China can be helped to better understand the forces that do shape its organizations, China should be able to harness those forces, keeping its organizations pointed in a positive direction.

This chapter describes the research method used to gain a better understanding of China and the considerations that were given to the special problems any study of China presents.

A. DATA

Three main sources of data were used for this study: general background studies, shipyard archival data, and interviews.

1. Background Studies

Background work consisted of several directed studies into the history of China and organizational theory, extensive reading of China news journals, and a general study of the U.S. and world shipbuilding industries. As part of this study several tours were made of U.S. shipyards. This background work was done both independently and under the direction of professors at the U.S. Naval Postgraduate School.

2. Shipyard Archival Data

The second data source consisted of documents, published articles, and reports obtained from Chinese shipyards, U.S. intelligence services, public magazines and journals, and other sources. This data source can be roughly divided into two categories: objective reports and reports issued by the shipyard or Chinese government. The reports in the latter category may be lacking in objectivity. The bibliography gives an indication of the types of documents reviewed.

In all cases any data examined were weighed against background knowledge of Chinese history and behavior and against information relayed by people having experience in or with Chinese shipyards or the international shipbuilding community. Data were reviewed for consistency and supporting evidence. Some data were inconsistent with actual observations of the behavior or control exhibited in Chinese shipyards. In these cases the two sets of conflicting data were examined further. The data were evaluated further and not simply discarded because of the chance that the actual observation, not the data, was flawed. Additional research focused on finding new information that would support one set of data or the other. If data could be endorsed by another source, that data were judged more valuable and probably more accurate. If the data just did not fit in with the most reliable information on China, they were discarded.

Consideration was also given to the objectivity of the source. An independent observer was considered more objective than a source working inside the Chinese shipyard organization.

3. Interviews

The last step of data collection involved interviewing a variety of China, shipyard and Chinese shipyard experts. These experts were important because they could lend critical perspective to the written reports that were available on Chinese shipyard management. Based upon the data gathered during the interviews, it was possible to objectively evaluate the other available data. These experts provided the perspective and knowledge necessary to separate reality from propaganda.

4. Perspective

In conducting the study it was necessary to define what constitutes the Chinese shipyard and its management control system. However, to understand the Chinese shipyard and its management control system, we must first look at the issues that are necessary to understand the Chinese environment. The three issues are the breadth of the topic, cultural bias, and informational shortcomings.

The first issue deals principally with the scope of the topic while the second two relate to special problems that must be addressed when studying China. All three relate to the perspective of the study and are critical in determining what value we can place on the research. Each issue is important enough to be addressed separately in order to weigh its impact on the entire study.

B. BREADTH OF TOPIC

Shipbuilding in China is essentially a government run industry organized into the China State Shipbuilding Corporation (CSSC). The organization of CSSC is outlined in *Business China.*

> The CSSC was set up in May 1982 to supervise the shipbuilding industry after the Sixth Ministry of Machine Building was abolished during the restructuring of the central government bureaucracy. Shipyards, ship repair yards, and other units formerly under the Ministry of Communication have been brought together under CSSC. CSSC ... has {approximately} 153 units under its jurisdiction. Of the total, 138 were formerly under the Sixth Ministry and 15 under the Ministry of Communication. Among the organizations under CSSC are 26 shipyards and ship repair yards, 66 ship fitting plants, 33 research and development units and three institutions of higher education ("China Industry," 10 November 1982, p.168).

With the large size of the shipbuilding organization in China and with the difficulty in obtaining accurate information on organizations in China, I could not look at the entire CSSC. Consequently, I have tried to focus on identifying the shipyards

that China sees as its principal yards. I identify the principal shipyards as the largest yard or largest two yards within each of the nine regional shipbuilding corporations. The advantage in using the largest shipyards which employ more resources, have a larger impact on the economy, and touch more people is that because of their far reaching impact more information is available about the activities in these shipyards.

C. CULTURAL BIAS

Fairbank, Reischauer, and Craig evaluate the cultural gap.

> The cultural gap {between the west and China} is enormous. {Any} understanding must be based on a knowledge and appreciation of the other peoples' different customs, attitudes, ideals, and forms of self expression.... Rapidly growing contacts during the past century have tended to lessen the cultural gap, but other factors have widened the gulf: first, a great upsurge of national consciousness and patriotic pride among the people {of China} ... second, a growing discrepancy in material standards of living; and third, a different experience of war and revolution. In part because of accidents of history and geography, westerners have achieved a far more favorable balance between population and natural resources than has been the case in East Asia, and this economic gap perpetuates and sometimes heightens the cultural differences (Fairbank, Reischauer, and Craig, 1978, p.2).

As Fairbank, Reischauer, and Craig point out, western society is very different historically, socially, culturally, educationally, and politically from Chinese society. For us to really understand any Chinese organization, we must be aware of these differences and take them into account.

This study began with general reading on China and its maritime industries. This work was necessary to better understand the cultural differences. Additionally, I strived to stay abreast of developments in Chinese society and expand my knowledge of the country and its people.

The perspective I developed guided my interpretation and evaluation of Chinese shipyard control. This perspective is important because understanding Chinese culture is necessary in order to define the environment in which the shipyard exists and recognize the forces that motivate and shape the direction of the shipyard organization.

A final issue relating to cultural bias is whether it is appropriate to use western standards and theory to evaluate and model a Chinese system? To answer this question one must understand the current direction of heavy industry in China. More and more the Chinese are working to upgrade their industrial plant through the use of

western technology, the implementation of western management skills, education of critical personnel in western universities, expansion through joint ventures with western firms, and even competing in western markets.

China's self-initiated courting of western technology and expertise gives credence to evaluating Chinese control systems through western eyes and with western standards. If China expects to adopt western tools and ways and to compete with western nations, China's progress to this end must be properly measured. The proper measure is one using western standards and theory. The question of how westernized in her organizational structure and management has China become is a meaningful question.

D. INFORMATIONAL SHORTCOMINGS

Obtaining complete, reliable, and accurate information on any aspect of Chinese society, especially a specific industry, is a difficult task. Several reasons exist to explain why Chinese society is not completely open for western examination: language, statistical accuracy, the political system, and the audit trail. Each is discussed below.

1. Language

The Chinese language in both its written and spoken forms is radically different from any Western language. As Fairbank, Reischauer, and Craig indicate, Chinese is a very complex language.

> {While Western languages tend to rely on relatively simple phonemic transcription, Chinese} characters tend to be rather complex.... At least two or three thousand characters must be memorized before one can read even simple texts. The emphasis on rote memory work to learn all these characters may have had a limiting influence in Chinese education, putting a premium on memorizing ability. The complexity of the system made literacy more difficult to achieve than it was in cultures with simple writing systems.... The writing system has become an increasing handicap in modern times as the need for widespread literacy has increased.... All efforts to construct a Chinese typewriter that is anything less than a small printing press or electronic brain have proved unsuccessful (Fairbank, Reischauer, and Craig, 1978, p.26).

This language complexity has two effects. First, it has tended to slow educational growth in China and reduce the emphasis on recordkeeping (Pye, 1972). Second, it makes it difficult for a westerner studying Chinese organizations to get access to primary sources. Any China researcher who does not possess significant skill in Chinese is completely dependent on translated materials and on people from the organizations who may be able to speak English.

I was able to work around the latter problem because of China's increasing interest in western markets, technology, and know how. Because China is working to expand her shipbuilding base using western resources and expertise material has been published in English print sources. Additionally, because of China's strategic significance in world affairs, U.S. intelligence services have studied China and compiled records on Chinese industrial development. I was able to use their files as well as interview their China experts. Finally, I was able to meet several English speaking people who had direct experience working with Chinese shipyard management.

The problem of little emphasis by the Chinese on accurate recordkeeping was a more significant problem. China's archives and archival system have significant weaknesses. The weaknesses exist because of language hinderances and the volatile nature of China's recent history--the disruptions of World War II, the Chinese Civil War, the Great Leap Forward, and the Cultural Revolution. In these periods incomplete records were kept (Choh, 1962 and Yuan, 1973).

2. Statistical Accuracy

In October 1952 the State Statistical Bureau (SSB) was formed to monitor China's economic performance. Six years later, however, during the Great Leap Forward the central statistical bureau was broken up and localized. The bureau was a casualty of the general decentralization of economic planning and management (Fairbank, Reischauer, and Craig, 1978, p.918). The attempt to localize record keeping did not work. After the break-up of the state statistical bureau, industrial record keeping became less reliable and critical information stopped flowing to central planners. The result was that not only were accurate records not being kept but statistical workers fearful of personal attack, (i.e., being charged with right wing conservatism or being accused of "lacking faith in the efficacy of the Great Leap" (Choh, 1962, p.85) deliberately falsified production and economic statistics and reports: "No one could afford to admit of anything but fulfillment {and} overfulfillment of their quota" (Choh, 1962, p.85). In short the people told the government what they thought the government wanted to hear. Consequently, the records that were being kept were incomplete, inaccurate, and unreliable.

During the Cultural Revolution (1966-1976) things only got worse as Field points out.

> No sooner had the statistical system begun to recover from the Great Leap Forward than the Cultural Revolution erupted. Li Cheng-rui, who was director

of the State Statistical Bureau until he retired in 1984, painted a vivid picture of statistical work during the years 1967-1969 inclusive. He wrote: '... statistical work came to a virtual standstill ... and the vast majority of cadres in the SSB were put to manual labor or simply fired. Although statistical work was not completely interrupted, most of the responsible people in statistical bodies in every province, region, county, and department were labelled as 'capitalist roaders' and were forced to struggle {against the Red Guard purges}, and many statistical systems were criticized as 'revisionist' (Field, 1986, p.625).

The state statistical system began to recover in 1970 with the SSB reconstructing the majority of national statistics and starting to keep an accurate accounting of national records (Field, December 1986, p.625). But after two significant purges of administrative and bureaucratic personnel, one could argue that statistical workers in China would be more concerned with recording good news than in accuracy and completeness. Additionally, the Cultural Revolution had brought a significant setback to China's educational system (Barnett, 1974, p.156, Hsu, 1982, p.103, and Lauriat, 1983, p.191). Because the universities and other higher level schools in China closed during the Cultural Revolution, most formal education stopped during this period. Many statistical workers did not have the opportunity to learn formal methods of recordkeeping or statistical techniques (Fairbank, Reischauer, and Craig, 1978 and U.S. Congress papers, 1986). As in many other segments of society, including shipbuilding, the training of capable people would take some time.

3. **Political System/Propaganda**

- Finally, China is a closed society with a communist government. Free press and freedom of information do not exist in China. Furthermore, it is sometimes difficult to determine what official data are propaganda and what are accurate information.

The Chinese are a proud people who want very much to compare favorably with the rest of the world. They do not hesitate to issue propaganda that helps raise their image in world circles (Hsu, 1982, p.115). This image consciousness casts a shadow on any information coming from the Chinese government. U. S. intelligence services frequently question official Chinese economic data and quite often adjust economic figures downward for accuracy. An example of this adjustment came when China initially claimed that coal production "had risen from 131 million tons in 1957 to an incredible 349 million tons in 1959" (U.S. Congress papers, 1986, Vol. 1, p.514). However, no evidence existed to support these claims, and western analysts had to adjust the figures downward.

The Chinese observer is continually faced with the problem of separating fact from fiction. Inflated figures have been reported in agriculture, steel, and ship production. A dramatic example of outrageous claims is the computer described below. In 1967 the Chinese news agency, Xinhua, reported the testing of a new transistorized general-purpose digital computer by the Computer Technology Institute of the Chinese Academy of Sciences. The computer "was said to be capable of assisting in the solution of problems arising in nuclear research, rocketry, and space flight. Every time it was turned on, said the report, the computer sang the song 'The East is Red,' drew a picture of Chairman Mao and, in an imitation of his handwriting, wrote the slogan 'serve the people'" (Jones, 1980, p.176).

The Chinese have admitted past problems with their statistical bureaucracy and economic record keeping, but say they have corrected these problems. Yet, coal production in 1959 is now reported to have been 369 million tons, a figure even greater than the initial claim. It appears that the statistics have been exaggerated and used for political purposes (Barnett, 1974). The Chinese want their experiments to appear successful and sometimes help them appear so (Barnett, 1974). Additionally, the Chinese way of calculating their statistics is often suspect (U.S. Congress papers, 1986, Vol. 1, pp.506 and 514).

Another problem is that the U.S. did not have official relations with the Chinese government from 1949-1975. This means that very little information was available on Chinese society and industry. During that period China had, to a large extent, shuttered its windows to the outside world leading to an incomplete historical record of what occurred.

4. Audit Trail

One way to verify the accuracy of Chinese industrial statistics is to conduct an audit. Unfortunately, because of language and other factors already mentioned China is not a country that places heavy emphasis on accurate record keeping. The Chinese just do not keep the records necessary to conduct a proper audit (Farrell, 3 April 1987). So other than by direct observation, there is no objective way to verify most of the information that the Chinese release about their country. Still, ways do exist to construct an accurate picture of what is happening in China. The way I chose is described below.

5. Solution

My solution to this problem was to look at a very wide spectrum of information. By examining a large quantity of data, I was able to look for data consistency and evidence that the data might be unreliable.

For each data source I examined the independence and expertise of the source by asking the following questions:

- Did the source carry any sort of prejudice for or against China?
- Was the source able to verify its data or were the data openly accepted from the Chinese government?
- Who actually collected the data?
- Are the data consistent with other data on Chinese industry and shipbuilding?
- What value did/do the China experts give the information?
- Are the data consistent with opinions/judgements of U.S. intelligence organizations, professional societies, and world markets?
- Was the data consistent with the purchasing patterns of Chinese ship buyers?

Final decisions on the value of a data source took into account all of these variables, especially whether the data were consistent with China's performance in the marketplace.

Of great value in evaluating data was my gaining access to sources inside Chinese shipyards. These sources had broad backgrounds. They included the retired chief executive officer of a U.S. steel making company who taught management to senior Chinese executives, including shipyard executives, a U.S. university professor (involved in a teaching program at the Hudong shipyard in Shanghai) who is experienced in engineering and industrial management, and a Chinese industrial engineer, now teaching in China, who studied shipyard planning and industrial management at the University of Michigan. Another source was a senior vice-president of the Shanghai Investment and Trust Company. This vice-president spent 24 years working as a design engineer at the Shanghai shipyard. I have also talked with and and interviewed numerous people of varying backgrounds who have either toured Chinese shipyards or who have had dealings with associated industries.

III. THE MANAGEMENT CONTROL SYSTEM

A. DEFINING THE MANAGEMENT CONTROL SYSTEM

Management control "is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives" (Anthony, 1965, p.17). However, no one best way exists to achieve effective control over an organization. The control that eventually evolves depends on the context in which the organization is operating (Euske, 1984). Euske argues that "management control is pragmatic. It is not an abstract description or process. Management control is meant to achieve goals within the specific environment in which it operates" (Euske, 1984, p.2). Flamholtz agrees, defining an organizational control system as "a set of mechanisms which are designed to increase the probability that people will behave in ways that lead to the attainment of organizational objectives" (Flamholtz, 1979, p.290). But, how do control systems orient behavior in support of organizational objectives? What means do they employ and what are the components of a control system?

Before I address these issues and talk about the specific elements of the Chinese shipyard control system, let's first explore the different levels of control that exist in the shipyard. Three levels of control exist in the shipbuilding industry: orienting employees to performance excellence, ensuring initial controls are effective, and convincing the consumer that level 1 and 2 controls are in place and working.

The shipyard must first orient their employees toward the efficient construction of ships and marine equipment that meet accepted levels of excellence. Initial controls such as the basic education of workers, technical training, planning, worker incentives, and management are necessary to achieve a basic level of organizational effectiveness. These controls both help ensure the delivery of all inputs to the construction process (labor, raw materials, and capital) as well as ensure these inputs are efficiently transformed into a quality finished product. These controls should be designed to shape behavior so that organizational goals are best furthered. These base level controls address such issues as personnel direction, motivation, technical knowledge, and analytical ability, all of which relate to effective and efficient ship construction.

The second level of control is oriented towards ensuring the first controls were effective. These controls, such as standards, quality control, financial statements, and accounting systems are designed to check the effectiveness of the base level control system. These controls provide feedback on how well the system is operating. They help answer the question: Is the system achieving what it was designed to achieve?

The third level of control is designed to convince the consumer that the previous two stages of operational control are in place and are effective. These controls include marketing, ship classification societies and registry organizations, and insurance companies. These controls help sell the product (the ships) to the consumer. This level of control is critical because consumer attitudes can determine the success of an organization.

Identifying the different levels of control is useful in that it helps begin identifying control system elements and demonstrating that each element in the control system has a specific reason for being a part of the system. The elements at the first two levels (the internal controls) are the specific devices the shipyard uses to control behavior and resources to achieve organizational objectives. The third level is external. I focus on all three levels in this paper.

What are the other components that make up the system? Borrowing heavily from both Euske (1984) and Anthony et al. (1984), I have developed a list of factors through which management control manifests itself and which I can use to define the management control system in use in Chinese shipyards. These control elements constitute a more complete listing of the devices the shipyard has at its disposal to influence behavior internal and external to the organization to advance its primary goal of building ship's marine equipment and other products that are in demand by the shipyard's market. Each item on the list will be discussed in this chapter as the paper identifies the means the Chinese are presently employing for shipyards control.

In Chapter V when I discuss the evolution of this control system, however, I will use only a small selection of these elements to illustrate how the resource dependency and institutional perspectives can be applied to the Chinese shipyard control system.

These particular control elements listed were selected both because they touch each of the three levels of shipyard control and because they offer a sampling of the organization's structure, productivity and quality controls, and financial controls. They offer a representative cross section of the organization. The control elements are:

- *Shipyard Organization*: How is the shipyard divided? Does a line diagram exist for the shipyard?

- *Division of labor*: How is work broken down and coordinated?
- *Employee Breakdown*: What skills are employed? What is the total number of workers employed?
- *Production figures*: What types of ships are built? What is the number of each type ship built? For whom are the ships are built and sold to?
- *Ownership*: Are all state owned?
- *Management*: To what extent can a shipyard director control his organization? Where does the management power lie?
- *Planning*: Is planning centralized or decentralized? Is it long range or short range? Who does the planning?
- *Marketing*: Who sells the ships? Which buyer is targeted? Who are the buyers?
- *Education*: What is the general educational level of shipyard workers? How is the country's education system set up to support the shipyards, both from a management as well as from the workers' perspective? Does education continue after a worker is employed in the shipyard and is education the same for management?
- *Training*: What technical training is required of managers? What technical training is required of shipyard workers? How is a skilled labor force developed? Are shipbuilding and heavy industry skills emphasized?
- *Incentives*: What incentives are management and/or workers offered? How are employees rewarded or punished: e.g., with salary structure, vacation, retirement, and/or with other benefits?
- *Quality control*: Do checks on the control system exist?
- *Standards*: Who sets these? Are they effective? What level of excellence is demanded?
- *Joint venture*: What role do foreign corporations play in Chinese ship production? To what degree is joint venture utilized?
- *License*: How much technology does China import under license? Is licensing important to China's shipbuilding industry?
- *Communication*: Does effective communication exist both within the shipyard and outside (state planning boards, etc.)? How are measures of performance communicated?
- *International ship registry organizations*: What role do these organizations play? Are established societies like the American Bureau of Shipping or Lloyds of London active? Does China have its own registry organization? Are any other international certifying organizations active in China?
- *Shipbreaking*: How is this important source of raw materials utilized? Why is it important?

- *Budgeting*: What process is used? Who or what decides the allocation of resources? Is budgeting centralized or decentralized?
- *Accounting Systems used*: Is more than one system used? What are the systems?
- *Financial Statements*: What statements are used? To whom do these reports go? Also, are there different reports for inside the shipyard and to outsiders?
- *Finance*: How are the ships paid for and financed?

It is through the shipyards' orientation and behavior in these important areas that the shipyard control system manifests itself. By looking as completely as possible into each of these areas we can see how the shipyard organizes itself and puts into motion the management of labor, raw materials, and industrial plant to produce ships for export and domestic use.

This section presented the control system elements. In the next section I organize a small sampling of these elements into specific groups to show how these elements actually came together to form a control system.

B. THE MANAGEMENT CONTROL SYSTEM

The individual control elements listed above can be collected into three groups: shipyard organization and structure, quality control and productivity, and financial control. Each group contributes to the development of different levels of control. Thus, weaknesses in any one area may prevent the organization from achieving control at the three levels.

Shipyard organization elements include shipyard organization, division of labor, employee breakdown, production figures, ownership, management, and planning. These control elements form the basic structure of the organization. Any presentation of a shipyard control system should begin with a description of these elements because they form the basic background for the organization. These elements indicate what the organization is about, who the organization is, and how large the organization is.

These elements are briefly discussed principally to help the reader conceptualize the Chinese shipbuilding industry. Of these elements only management is discussed at length in Chapter V, illustrating how Chinese shipbuilding focus changed between institutional legitimacy and concern for resources. Management issues are addressed in Chapter V through such areas as management training, the factory director responsibility system, and corporate memory. Production figures are also mentioned in Chapter V to indicate the change in shipbuilding output that occured as the shipbuilding industry underwent control system change.

The second division of control elements is quality control and productivity. Elements in this group include marketing, education, training, incentives, quality control, standards, joint ventures, license, international ship registry, and shipbreaking. Quality control and productivity elements are, in one way, the heart of the control system in that they differentiate between efficiency and effectiveness in the organization. Because in some ways efficiency and effectiveness concerns differentiate between resource dependency and institutional perspectives, these elements are very important in describing how and when each perspective can be applied to the shipyard control system. The discussion in Chapter V centers to a large extent around the quality control and productivity elements. Only shipbreaking is not discussed.

The final group of control elements include financial control factors such as budgeting, accounting system, financial statements, and finance. These elements are found in every organization and are mentioned in this chapter only to complete the picture of the shipyard control system. Because of the scarcity of available data, these control elements are not discussed in conjunction with either the resource dependency or institutional perspectives.

The specific control system information that follows comes mainly from a mix of the major Chinese shipyards: Dalian, Shanghai, Hudong, and Jiangnan. Information is concentrated on these yards simply because they are the largest shipyards in China. However, where available, information on small and medium sized shipyards was also obtained and used. From this mix of information, I developed a description of the basic management control structure found in Chinese shipyards.

C. SHIPYARD ORGANIZATION ELEMENTS

1. Shipyard Organization

The CSSC is the organization responsible for all facets of shipbuilding in China. Material and technical resources include all of the shipyards and ship repair facilities in China, the 66 ship equipment factories, approximately 30 research and design institutes, and three institutes of higher education, including Shanghai's Jiaotong University. CSSC employees number 300,000 ("New Management," 1982).

The CSSC is organized on a three tier structure. At the top is the corporation headquarters in Beijing. Next, are the nine regional shipbuilding corporations that have been set up in Shanghai, Tianjin, Guangzhou (including Guangxi), Jiujiang, Wuhan, Chongqing, Xi'an, Kunming, and Dalian. Finally, at the lowest level, are the

individual factories, shipyards, repair yards, research and design facilities, and training institutes.

a. Beijing: Corporate Headquarters

The Beijing headquarters, under the direction of the State Council, makes all major shipbuilding decisions. It is the heart of the CSSC, where the real power and control over the organization are exercised. Headquarters is responsible for ensuring that state shipbuilding policy is carried out. To this end they plan the annual domestic and export output of each regional corporation as well as the degree to which each regional corporation is to be financed each year. The CSSC also controls the distribution of profits throughout the organization, while ensuring that taxes are paid to the state (NAVSCITECHGRUFE, 26 November 1982).

The headquarters operates under a general managerial responsibility system. Leadership is provided by a board of directors that makes major decisions. These decisions are passed to the general manager who carries out established policy. The general manager in carrying out the established policy, "has absolute control over the production, operation, and administrative activities of ... {all arms of the} CSSC" (NAVSCITECHGRUFE, 26 November 1982).

The CSSC headquarters is equal to the other government ministries falling directly under the China State Council. The headquarters was formed to replace the old Sixth Ministry of Machine Building which was abolished in 1982. Appendix B provides an organizational line chart of the CSSC organization and illustrates its relationship to the China State Council (Lauriat, 1983).

The CSSC catalogue describes two of the corporations that corporate headquarters conducts its operations through.

> Two arms {of CSSC headquarters} are articulated in Beijing. One is China shipbuilding Trading Corporation Limited (CSTC), responsible for its trading business including export of ships and marine equipment, import of materials and expertise, and undertakings of construction of shipbuilding facilities and other building. The other is China Offshore Platform Engineering Corporation (COPECO) who is responsible for its offshore business and to act as general contractors or contractors for offshore fabrication and construction projects (CSSC Catalogue, 1987, p.1).

The CSTC is concerned, chiefly, with foreign trade activities.

b. The Regional Shipbuilding Corporation

The regional corporations located in Shanghai, Dalian, Guangzhou, Tianjin, Wuhan, Chongqing, Xi'an, Jiujiang, and Kunming were formed to control the yards, plants, and institutions within their respective geographic areas (CSSC Catalogue, 1987).

The Chinese modeled their shipyards after Soviet shipyards while rebuilding them in the 1950's and 60's. In this effort they received extensive Soviet assistance (Muller, 1983, p.31, 61). The Soviets have always sought to make their shipyards self-sufficient. For each shipyard, the Soviets would build a self-supporting infrastructure of related industries, marine equipment factories, training institutes, R & D centers, and design institutes. They would merge these different industries around each shipyard into a selfsufficient shipbuilding production association (Butman, 6 May 1987). The problem with this organization is that it led to a duplication of facilities. But regardless of the system's strengths and weaknessess, this was the shipbuilding organization the Soviets gave to the Chinese.

When the Chinese began reorganizing their industry in the early 1980's, they had a number of self-sufficient, independent, shipbuilding organizations along China's coast. When the CSSC was formed in 1981, these self-supporting groups of shipyards and related industries lent themselves to the formation of regional corporations. The use of regional corporations was a logical way to administratively group the geographically separated shipbuilding centers under CSSC Beijing headquarters.

The typical regional corporation consists of all the shipyards in that area, a collection of marine instrument and equipment plants, several research and design institutes, and often a technical training institute. The oldest regional corporation is the Shanghai Shipbuilding Corporation created in August 1981. In that merger, 28 shipyards, including the Jiangnan, Hudong, and Shanghai shipyards, formally linked with the Marine Design and Research Institute of China, the Shanghai Merchant Ship Design and Research Institute, Shanghai's Chongming Island shipbreaking yard, Shanghai Marine Instrument Plant, Shanghai Mast Headlight Plant, the Shanghai Electrode Plant, and other area marine equipment factories (Lauriat, 1983, p.172, NAVSCITECHGRUFE, 5 March 1982, and "China Industry," 16 March 1983, p.40). Similarly, the Dalian shipbuilding corporation includes the Dalian shipyard, the Bokai shipyard, the Dongfeng machinery factory, the Northeast Material Control Office, the Bo Lai Shipbuilding Technical School, and other area firms (CTG 168.5, 18 May 1984).

Each of the regional shipbuilding corporations is organized along the same lines as CSSC headquarters with a board of directors and a general manager. The regional corporation has its own accounting system, consolidating input received from each of its units. The regional corporation submits its reports to CSSC headquarters (CTG 168.8, 18 May 1984).

Besides the regional corporations already mentioned there is also the China United Shipbuilding Company Limited in Hong Kong. This corporation is set up to handle CSSC business in Hong Kong and Southeast Asia (CSSC Catalogue, 1987).

c. The Individual Shipyard

Since I have already discussed briefly the national shipbuilding organization under the CSSC, this section will concentrate on the individual shipyard using Hudong shipyard as an example.

Each shipyard uses the same organizational structure that the Beijing headquarters and the regional corporations use. The board of directors, called "The Personnel Congress," meets annually to decide major shipyard policy questions (Yang, 1982, p.69). The shipyard director is the top individual in the shipyard. He is responsible for ensuring the Personnel Congress's policy is carried out and that the shipyard operates smoothly.

Under the shipyard director the organizational structure splits into an administrative side and a production side. The administrative side is concerned with all of the support activities that are necessary to support production. These activities include all management activities other than direct workshop supervision. Management activities encompass production planning, production management, and quality control (Yang, 1982, p.50). Planning involves work load, production field, and manpower balancing. The planning department prepares production instructions and milestone schedules (Bunch, 1987c). Production management coordinates all of the production activities for the entire shipyard, while the production department ensures the production plant will support production activities. The production department also coordinates shop activities. The administrative organization also includes the shipyard business office, shipyard safety, the supply department, education and training, design, research and development, technical innovation, electrical power, labor relations, maintenance, finance and accounting, communal enterprise management, and sales and marketing (Yang, 1982, pp.15, 50).

The production side is headed by the shipyard chief engineer. The chief engineer has principal control over actual production activities (e.g., shop work, quality control, design, and all technology matters) (Bunch, 1987c and Yang, 1982, p.56). The production organization is divided into workshops. The main shop is the hull construction workshop which is responsible for all steel production and hull fabrication. Other shops include the outfit shop, electrical workshop, foundry workshop, marine engineering workshop, machinery workshop, painting and wood working shop, valve shop, and the machinery repair workshop. Different shipyards will differ as to the exact number and type of shops they have (Bunch, 1987c and Yang, 1982, p.51).

Some shipyards also have an engine division. The engine division is responsible for the production of marine engines. Depending on the size of the yard, the engine division may simply be a shop under the production organization. In the larger shipyards it tends to be a separate entity under the shipyard director and the chief engineer. In still other situations the engines are produced by a separate engine company under the same regional corporation which controls the local shipyard (Bunch, 1987c).

The shipbuilding and engine divisions are the production divisions for the shipyard. They produce the actual output goods for the shipyard. As mentioned above, each of these divisions is further broken down into a collection of departments and shops.

2. Employee Profile

This section profiles the workforce in a typical Chinese shipyard by examining the workforce in a medium sized shipyard. The data are shipyard non-specific. Instead of illustrating the actual conditions found in one Chinese shipyard, the data presented are an average of conditions found in medium sized shipyards throughout China. The section emphasizes the character of the workforce instead of just listing skills employed. The section does not try to describe all the skills utilized in the Chinese shipyard.

The section profiles only the shipyard workforce instead of the entire CSSC workforce because the shipyard is the principal organization within the shipbuilding industry. The CSSC is a diverse organization employing a complete spectrum of shipbuilding personnel from management executives, to engineers, welders, pipefitters, draftsmen, shipfitters, machine operators, and unskilled laborers. To give a complete

breakdown of every branch organization under CSSC headquarters is beyond the scope of this paper. More information on the numbers and skills employed for each branch organization can be found in the 14 part *Business China* (1982, 1983) series on Chinese shipbuilding. A general picture of employee breakdown is provided.

The largest shipyards in China, such as Dalian or Hudong, employ approximately 10,000 employees, while smaller yards employ proportionally fewer workers ("China Industry," 5 January, 1983, p.7). A medium sized shipyard in China such as the Huangpu shipyard located near Hong Kong employs approximately 4,000 workers ("China Industry," 9 February 1983, p.23).

Figure 3.1 provides the employee distribution for two key workshops in a typical medium sized, Chinese workshop.

As we can see the outfit shop has larger loading of management and foremen than does the hull construction workshop. Eleven percent of all personnel in hull construction are supervisors or managers compared to 15 percent in outfit. Additionally, the number of direct workers per supervisor/management is 7.3 for hull and 5.4 for outfit. This difference may be due to the more complex and diversified work done by the outfit shop, work requiring greater direct supervision. Both shops are evenly balanced in terms of staff and support personnel. Approximately one-seventh to one-eighth of all shipyard workers are employed in hull production (Yang, 1982, p.56).

Figure 3.2 provides an overview of the entire employee breakdown for a medium sized Chinese shipyard. The administrators include managers, foremen, and some staff.

The following points should be highlighted. Compared with other world shipyards, Chinese shipyards have a significant shortage of staff personnel and engineers (Yang, 1982). Additionally, Chinese shipyards tend to have a proportionally large indirect labor force compared with other shipyards around the world (Yang, 1982, p.57). Both of these facts reflect weaknesses in the Chinese shipyard control system by indicating inefficiencies in the Chinese shipyards. The shortage of staff personnel and engineers cause inefficiencies in that planning, coordination, and design work do not receive the optimum degree or attention (Yang, 1982). This translates into more problems in operations. A large indirect labor force is inefficient because their role is strictly support. Because each worker is an added cost to production, if that worker does not add more to production than his cost, the efficiency of the yard is reduced.

Hull Construction Shop

Group	*Mgr*	*staff & Eng*	*fore -men*	*indirect AF*	*indirect Wkr*	*direct AF*	*direct Wkr*	*total*
Production plan & Engineering	4	15	1	0	2	1	8	31
Hull Fabrication	1	2	3	0	1	6	95	108
Assembly stage	0	2	4	0	0	8	110	124
Erection	1	1	5	1	2	10	140	160
Allocation	1	3	4	2	6	8	80	104
Total	7	23	17	3	11	33	433	527
Outfit Shop								
Production plan & Engineering	3	7	1	1	5	0	0	17
Deck Fitting	1	3	4	1	2	8	70	89
Livingquarters Fitting	1	3	4	0	2	8	70	98
Machinery Fitting	1	2	3	0	0	6	60	82
Electrical Fitting	1	3	3	0	0	6	65	78
Painting	1	1	3	0	1	6	45	57
Total	8	19	18	2	10	34	310	401

key:mgr = manager, AF = assistant foremen, wkr = worker
Source: Yang, 1982

Figure 3.1 Employee Breakdown for Hull and Outfit Workshops.

3. Production Figures

China is one of the world's major shipbuilding nations. As of December 1986 the U.S. Maritime Administration and *Lloyd's List* placed China among the top 10 shipbuilding nations in the world (*Lloyd's List*, 1986, and Heine, 1987, p.22). And, China is rapidly expanding ship production. This section looks at the type and level of Chinese shipyard output. It is an important area because it gives us valuable insight into the scope and complexity of the organization.

Figure 3.3 presents the Chinese shipyard output from 1 July 1984 until 1 January 1986. The table shows that China has the capability of producing a wide

Employee type	*number*	*proportion*
Direct & Asst. Foremen	2376	0.72
Administrators	231	0.07
Technicians & Engineers	198	0.06
Indirect & Asst. Foremen	495	0.15
Total	*3300*	*1.00*

Ratios	
Direct labor/Indirect Labor	2.6
Direct workers & Asst. Foremen/Indirect Labor	4.8
Administrators/Direct Workers & Asst. Foremen	0.1
Managers & Foremen/Direct workers & Asst. Foremen	0.06

The employees can be broken down further to:

Employee type	*Number*	*Proportion*
Managers and Foremen	146	0.044
Staff and Engineers	316	0.096

Source: Yang, 1982

Figure 3.2 Chinese Shipyard Employee Breakdown.

variety of ships though it builds mostly freighters, tankers, and bulk carriers. These category ships are the least specialized and involve less complex construction. China tends to do best when it sticks to this simpler type of vessel (Lloyd's List, 1986).

In addition to the ships listed, China also has built, or has the capability of building, a variety of other vessels and marine equipment. China advertises the following vessels in its shipyard catalogues: a variety of military vessels, fiberglass skiffs, multi-purpose cargo ships, hydrofoils, ocean-going salvage vessels, drilling rigs, salvage tugs, air cushion vehicles, passenger lines, and more. Chinese shipyards have the capability of building and repairing vessels of over 100,000 dwt.

Besides new vessels, Chinese shipyards advertise the manufacture of a large variety of marine equipment. This equipment includes marine hardware--towel rods, soap dishes, door fasteners, locks, etc.--marine diesel engines including Sulzer, B&W, and Pielstick diesels built under license, Chinese designed diesels, marine auxiliary

Ship type	*number*	*tonnage (x1000 dwt)*
freighters	13	115
containerships (full)	3	36.7
containerships (partial)	5	33.8
bulk carriers	8	179.5
combination passenger/cargo	2	14.8
tanker	5	102
refers	0	0
barge carriers	0	0
ro-ro	0	0
car carrier	0	0
timber carrier	0	0
ore carrier	0	0
collier	0	0
chemical tanker	0	0
molasses tanker	0	0
total	36	481.8

These figures are incomplete because they include only the major vessels built in Chinese yards. Source: Heine, 1987

Figure 3.3 Chinese Ship Production 1 July 84 to 1 January 86.

equipment, marine outfittings, ship containers, diesel generating sets, and other marine products.

Finally, Chinese shipyards produce a wide range of non-marine products. These products include forklifts, bicycles, machine tools, heavy industrial equipment, valves, agricultural equipment and much more. Shipyard production in China seems to be limited only by the imagination and influence of the customer requesting the product.

4. Ownership

The CSSC is wholely owned by the Chinese government. No private ownership or stock exists for any CSSC enterprise (Lauriat, 1983 and Zhang, 10 April 1987).

Government ownership includes all levels of the organization from the central CSSC operation in Beijing, directly under the control of the Chinese State Council, to the regional corporations that have been formed in Shanghai, Dalian, Guangzhou, Tianjin, Wuhan, Chongqing, Xi'an, Jiujiang, and Kunming, and finally to the yards, plants, and institutions operated by these regional corporations. Government ownership even extends to special corporations, like the International United Shipping Investment Company Limited and the China Shipbuilding Trading Company, which were formed specifically to negotiate (and to enter into contracts) with ship buyers abroad.

The CSSC and CSSC associated enterprises are operated as independent units under the direction and control of central CSSC offices in Beijing. Each enterprise is managed on a self-sustaining basis where operations are expected to generate sufficient sales to completely fund the enterprise as well as to return a profit to the government. Each enterprise thus operates as an independent economic body. Day to day operations are the responsibility of local management and long term direction is provided by the State Council. Although called a corporation, the CSSC is actually equal to other government ministries. So, while its name may be misleading and its method of operation relatively independent, shipbuilding in China is completely a government operation (Lauriat, 1983 and Zhang, 10 April 1987).

5. Overall Management

Business China points out that overall management of shipbuilding in China is centered at CSSC corporate headquarters.

> The CSSC is a national corporation directly under the State Council, which places it on a level with the {other Chinese state} ministries, {like Machine Building, Communication, and Finance}. The CSSC is responsible for planning and supervision of the shipbuilding industry. It deals directly with domestic and foreign companies, enterprises, and institutions ("China Industry," 1983).

The CSSC central offices in Beijing are where all major corporate decisions are made. There the bulk of marketing, sales (both foreign and domestic), contracting, finance, the hiring of all major shipyard management, and production decision activity takes place. The local shipyard takes the input supplied by Beijing and attempts to meet the production goals that were set (Zhang, 1987).

A design engineer from Shanghai shipyard emphasized the socialist way of managing organizations in China: China is a socialist country where the best planning

is done centrally with the local shipyard management having little say in production decisions. Since the government controls the whole country, this is the best way to plan the shipyard's work and coordinate it with the rest of the country (Zhang, 1987). Local shipyard management and management of support organizations like research and design units and institutes of higher education are also under the Beijing bureaucracy. All coordination between units is handled by the central bureaus of the CSSC (Zhang, 1987).

Recently, new emphasis has been placed on increased management responsibility for factory directors. In January 1987, *China Daily* reported new regulations that would put full production and management responsibility in the hands of factory directors ("New Rules," 1987, p.1).

This move is seen as a "major reform of China's enterprise leadership" ("New Rules," 1987, p.1). Under the new system factory directors are expected to use new decision making power over operations and production and to mobilize trade union and Communist Youth League organizations in an effort to help their organizations run better ("New Rules," 1987). Under the new system factories will still be responsible to the supervision of party organizations and workers' congresses ("New Rules," 1987).

The factory director responsiblity initiative if applied to Chinese shipyards would tend to decentralize operations, giving the local shipyard more say over the major production decisions. Hudong shipyard has been designated as a pilot enterprise to implement this new management system (Bunch, 1987c) as have other shipyards. While it is too soon to see how well the new system will work and how much responsiblity the factory directors end up having, the change does represent a major shift in Chinese shipyard management.

6. Planning

Comprehensive goals are formulated at central CSSC headquarters in Beijing, while the planning to accomplish these goals also takes place in Beijing ("China Industry," 10 November 1982, p.168). Planning on the national level includes such areas as the level of production for each shipbuilding region, the setting of production and profit targets for the regional corporations, and the allocation of raw material. Contracts with foreign concerns, level of local investment, and joint ventures are also planned at the national headquarters level (Yang, p.69, and Zhang, 10 April 1987). Once plans are formulated they are sent to the regional corporations. (USDAO, 1986, and NAVSCITECHGRUFE, 5 March 1982). The regional corporation is responsible

for formulating plans for each shipyard and local organization under its control as well as keeping CSSC headquarters informed as to the progress in carrying out the plans (NAVSCITECHGRUFE, 5 March 1982).

On the local shipyard level, production planning is the principal planning done. This involves work load, production field, and manpower balancing (Bunch, 21 April 1987). Shipyard planning is accomplished by establishing milestones for each individual job. Key milestones might include obtaining raw materials, laying the keel, launch, and delivery (Bunch, 1987c). Initial planning takes about one month and is done by production management. Each job is then coordinated in with the yard's overall plan developed by the shipyard planning section (Bunch, 1987c). At least monthly a shipyard-wide planning meeting is held. This meeting is attended by the planning representative from each shop and the shop heads, and is chaired by the shipyard's vice-director. The meeting is used to resolve any planning conflicts and to try to improve yard efficiency (Bunch, 1987c). The local shipyard is responsible for keeping the regional shipbuilding corporation informed on its progress in carrying out all plans.

D. QUALITY CONTROL AND PRODUCTIVITY ELEMENTS

1. Marketing

The role shipyards play in marketing is changing rapidly. In the past shipyards had almost no say over the marketing of the goods they produced. Production quotas would be assigned to the shipyard and raw materials, labor, and a buyer provided (Sensenbrenner, 1987, p.35). Although that system seems to remain largely in place, there is some evidence that change is occurring. This section looks at current shipyard marketing practices for both domestic and foreign sales.

a. Domestic Sales

The China Ocean Shipping Company (COSCO) under the Ministry of Communications is the Chinese national merchant ship operator. This firm and its subsidiaries negotiate the purchase and construction of the majority of Chinese operated merchant tonnage. The largest Chinese shipyards also build military vessels for the People's Republic of China navy as well as for export. Commercial sales to the China Ocean Shipping Company are negotiated, primarily, between COSCO and CSSC at the headquarters level in Beijing (Jones, 1981, p.42 and Zhang, 1987). Once a purchase is agreed upon, CSSC headquarters allocates that job to a yard with sufficient capacity and the technical know-how to do the job. After the contract has been

assigned, the shipyard may at times negotiate further with the COSCO subsidiary accepting delivery. The additional negotiation may involve a number of issues including price, delivery date, or shipboard equipment (*Lloyd's List*, 1987 and "Shipbuilding in China," 1985).

In the past several years reports indicate that local shipyards and regional shipbuilding organizations are assuming more authority in marketing their output ("China Industry," 1983). *Asian Shipbuilding* reports that the Dalian shipbuilding Industrial Corporation (DSIC) enjoys considerable marketing autonomy under the CSSC umbrella: "The DSIC can negotiate directly with clients both at home and abroad, which makes for a simpler contract between customer and builder than is the case with other yards" ("China Fights," 1987, p.15). Additionally, Jiangnan Shipyard in Shanghai has some authority to negotiate with domestic and foreign buyers after initial contracting is complete (Fletcher, 1986). Finally, in July 1983 "Shanghai Shipyard concluded an agreement with the Shanghai Maritime Transportation Administration Bureau, for the construction of six 20,000 dwt bulk carriers (CTG 168.5, 15 January 1984). The regional shipbuilding Corporations and local shipyards do have some authority to market their products. Whether the trend to place more marketing authority in local and regional hands will continue to increase remains to be seen. For now the practice does not yet appear to be widespread and marketing remains, principally, at CSSC headquarters level ("China Fights," 1987 and *Lloyd's List*, 1986-1987).

b. Foreign Sales

Foreign sales appear to be handled in much the same way as domestic sales with the slight difference that CSSC overseas subsidiaries like the China Shipbuilding Trading Company, Ltd. and China United Shipping Co., Ltd. become more involved in the process of locating and negotiating with buyers.

In the past several years both the regional corporation and the local shipyard have become more involved in export marketing, though the bulk of sales still seems to be controlled at the CSSC headquarters level. The Dalian Shipbuilding Industrial Corporation appears to be leading the way in decentralizing marketing ("China Fights," 1987, p.15), though each regional corporation supposedly has some control over sales and production and "can directly negotiate and conclude contracts with customers both at home and abroad" (NAVSCITECHGRUFE, 5 March 1982).

As an attraction for foreign buyers, the CSSC, each of its regional shipbuilding corporations, and its primary shipyards have begun issuing a full color sales catalogue detailing the vessels and marine equipment they are ready to build as well as advertising their facilities and organization.

Besides catalogues, the Chinese market their shipyard production through international shipbuilding and trade conferences, overseas trade subsidiaries, government trade agreements with foreign countries, and counter trade agreements with foreign firms looking to do business with China (Jones, 1981, p.42, CSSC Catalogue, 1987, and Wang, 1980).

2. Education

To help understand how the management, engineers, and laborers employed in Chinese shipyards are educated, an understanding of how the Chinese educational system works is useful. I will briefly explain the major mechanisms of that system then explain how the shipyards and shipyard suppliers interact with that system.

The Chinese educational system is a compulsory nine year program. Beyond this program further education is available via intermediate vocational and technical training, local colleges or universities, national universities, foreign universities, and the invisible university. Post secondary education is based on the student's performance in secondary school and performance on admission exams for the school of choice. An additional means of gaining post secondary education is to know someone with enough power to get you admitted (Bunch, 1987a). Since technical and vocational education is very much industry specific, we will call that "training" and leave any discussion in that area to the paper's training section (Bunch, 1987b).

Since 1980 the annual growth rate of students in all kinds of higher education institutions has been 8.3% with the total population increasing from 1,114,000 to 1,703,000 in 1985 (Cheng Kai-Ming, 1985, p.1). In 1983, a projected recruitment target of 550,000 students in 1987 was set for formal higher education institutions; however, by 1986 the actual target increased to 600,000 students. Chinese education is expanding more rapidly than even the most optimistic projections. However, if the country is to quadruple economic production by the year 2000, the annual output from higher education is still far short of the demand for qualified manpower (Cheng Kai-Ming, 1985, p.1). To solve this problem, the Chinese government instituted some radical changes in the educational system ("Education of New Cadres," 1985, p.1). These changes give the educational system its flavor and provides the means for the

shipyards and associated industries to train their personnel ("Education of New Cadres," 1985).

On May 29, 1985 the Central Committee of the Chinese government announced their decision to reform the country's educational system. Reform was necessary, they said, to keep education on pace with China's advancing economy ("Education of New Cadres," 1985, p.1). This reform would involve government relinquishing (to the universities and industry) a degree of control over college enrollment and job assignment after graduation. The universities would gain the most power.

New for the universities would be the autonomy to accept any student sponsored by a funding organization or industry. The universities would also be given more authority over educational matters, such as structuring curricula or selecting textbooks. The universities would also have more say over funds received from the state and, for the first time, could raise funds on their own. The universities were given control over their administrators to hire or fire (presidents excepted) as they saw fit. Finally, they were given the freedom to solicit and engage in joint research projects with industry or other organizations ("Education of New Cadres," 1985, p.1).

The new autonomy given to the universities helped make industry a more active participant in education. Under the joint research program and industrial sponsorship of student's program, industry began to work more closely with universities to fill their educational needs ("Education of New Cadres," 1985). A direct interface was established between an employer, who funded the education of a worker, and the university, that provides the education. One program that evolved was commissioned enrollment.

Under commissioned enrollment, shipbuilders and other industries contract with local and national universities for the education of selected employees. The contracts call for the university to train a set number of students in the skills the industry needs. These students are then employed by the client enterprise upon graduation. The student may or may not come from an existing employee of the enterprise. If the student is not sent by the enterprise, the university designates the student. In return, the enterprise pays the recurrent expenses for each student and a considerable portion of the capital cost. By participating, the university increases its capacity and creates a new source of funding. Besides better educated workers, the industry can work with the universities to tailor new programs to better fill industry's needs (Cheng Kai-Ming, 1985, p.3).

Using this method, the shipyards and their suppliers educate the majority of their workers who require post-secondary education. Since shipbuilding is such a high visibility and strategic industry, it also receives a percentage of students who are sent abroad for technical and managerial training. Additionally, whenever a visiting educator from a foreign university is available, shipyard management and engineers are given special access to take advantage of that educator's knowledge.

The last source of education available to shipyard workers is the invisible university. The invisible university consists of televised and radio broadcast courses. This "university," operated by the Ministry of Education and the Ministry of Broadcasting, serves 1,500,000 students. Students are registered and can elect to study full-time, half-time or after-hours. Workers make up ninety percent of the full time students.

Broadcast education has its advantages. "As Premier Zhao Ziyang put it: 'the TV University fits the conditions of China; it is a faster and more economical way of training talents'; to train a student in the TV University costs the State one-third of what it costs for one in a regular college" ("Education of New Cadres," 1985, p.2).

3. Training

Training is centralized on the higher levels and controlled by the local shipyard on the basic shipyard skill level ("Education of New Cadres," 1985, and Bunch, 1987b). On all levels the quality of training is weak (Bunch, 1987d and Smith, 1987). Three rough levels of training exist.

On the highest level, workers are eligible for advanced, university type training. "The worker must be admitted by the institution, and if the skill is deemed important to the shipyard, the tuition and release time (with pay) is provided. In some instances the skill is deemed so important that the student is sent abroad for the training." (Bunch, 1987b) Additionally, some higher level engineers and managers have also been sent abroad to study at foreign universities.

On the middle level, the CSSC has training centers at Zhenjiang, Harbin, Shanghai, and Beijing where more specialized short term training is conducted. At these training centers special production/engineering skills are taught such as special welding techniques. Also, these centers offer short "programs for engineers and managers on such topics as total quality control, accuracy control, and group technology. The special production/engineering courses are sometimes taught right within the shipyard (Bunch, 1987b).

On the lowest level is a general training program that ranges from 6 to 12 months, depending on what the worker needs. This program, available to all workers, runs half time: the worker spends half time on the job and half in the training program. "The training is termed 'cultural', i.e., bringing reading and writing skills up to a standard, some political indoctrination, and general education of shipyard practices" (Bunch, 1987b).

Finally, in all of the Chinese shipyards there is a major emphasis on foreign language training. Most of this training covers English, though Japanese is also taught (Zhang, 1987).

4. Incentives

For the period or time included in this study the Chinese have had difficulty providing adequate incentives to increase productivity and improve quality. Chinese workers are guaranteed a lifetime employment. But because of a weak economy, the payscale for workers has been universally low. And even if the workers were paid a higher wage they had few consumer goods on which to spend this extra income. Put simply, money was not an incentive for the shipyard worker.

But what of other rewards? Did other non-material incentives exist? Briefly, no. Other possible incentives might include job satisfaction, pride of effort, a position of power, or autonomy of action. While these incentives are harder to identify without visiting China, the indication is they did not exist. Two reasons explain why.

First, from the Chinese civil war to the Cultural Revolution considerable social upheaval occurred in China. This had a de-stabilizing effect on the lives of the majority of the population (Cheng Nien, 1987). Job upheaval was common, re-education frequent, famine was often a threat, and few fellow workers could be trusted (Cheng Nien, 1987 and Fairbank, Reischauer, and Craig, 1978). This tended to reduce or remove any non-material incentives, such as the ones listed above.

Second, throughout the history of China's communist government, the state has maintained firm control of most enterprises (Jones, 1980 and U.S. Congress papers, 1986). Further, a firmly entrenched bureaucracy exists in China, leaving little opportunity for advancement (Barnett, 1974). These factors mean that autonomy of position is limited. In China there is always someone telling you what to do.

There is opportunity for autonomy of action in carrying out the revolutionary spirit in China. We saw this in the Cultural Revolution when the young, unheralded Red Guard took the country by storm (Fairbank, Reischauer, and Craig, 1978). In

this inst nce young, ambitious Chinese did have satisfaction in what they were doing and autonomy of action. The results were dramatic. Unfortunately, their enthusiasm was often pointed in a negative direction.

No incentive system existed in Chinese shipyards until the late 1980's. Dalian shipyard began the first experiments in providing incentives to shipyard workers. Recognizing that productivity was too low and "that the major problem was that of management and unmotivated workers, ... {Mr. A Wang, the deputy manager of the shipyard} said that management techniques are being improved as managers acquire more experience in overseas practices. In addition, a bonus scheme has been introduced which would not have been permitted a few years ago. Some workers can double their pay with bonus incentives, and the monthly wage costs have gone up by 20 percent since the scheme was introduced" ("China Fights," 1987, p.15).

While it is still too early to see if these incentives will have an positive effect in increasing the shipyard's productivity, it is noteworthy that China has experimented in this area to try and increase productivity. For the first time China seems willing to experiment with material incentives to improve industry productivity. At this time it is unclear if any controls have been implemented to go with the new bonus system to ensure that quality is not sacrificed ("Factory Director," 1986).

5. Quality Control

Quality control in China is an issue much talked about, but its progress has been incredibly slow ("Economic Commission," 1986 and Smith, 1987). The past few years China has been placing an increased emphasis on improving the quality of her manufactured products. Quality control leadership has come from the highest levels of the Chinese government. The head of China's government, Deng Xiaoping recently said, "we cannot only stress production quantity. We must also pay attention to production quality. In order to open our export market, the key issue is quality. When production quality is low, the products still become less competitive. In the past, we only stressed output value and quantity instead of quality. Actually, the most important issue is production quality" ("Economic," 1986, p.k33). In support of this speech "the State Economic Commission called on various districts and departments to earnestly study Comrade Deng Xiaoping's view, truly adhere to the principle of 'quality first,' quicken their pace in meeting international standards, and strengthen quality control in an overall manner ("Economic," p.k33). The Chinese have much work to do.

Mr. Phil Smith, a U.S. steel company executive who has experience in China, claims that, "China has no quality control program at all" (Smith, 1987). Yang Siyuan, a Chinese professor with shipyard experience, agrees with this perspective. "China has ... great potential in the international shipbuilding industry, {but}, the problem right now is that Chinese shipbuilding technology is not advanced in techniques such as scheduling, organization of work, pre-outfit approach, shipbuilding standards, dimensional control, quality control, and computer aid" (Yang, 1982, pp.82, 83).

However, Chinese shipyards do have a quality control structure in place, even if it is not effective. Part of the shipyard administration includes a quality control department. This department is unique in that while under the shipyard's administrative organization (Yang, 1982, p.50), the department reports directly to the shipyard's chief engineer (Bunch, 1987c). The quality control department or section consists of a measuring division, a quality inspection division, and a quality control office. The "department is responsible for developing quality control procedures, and maintaining an inspection program to confirm that the worker is building products to the assigned quality standards. The department is also the official liaison with the owner's representative and the various regulatory agencies (e.g., American Bureau of Shipping) who regularly inspect the ship during its construction" (Bunch, 1987c).

In addition to the formal quality control program that the shipyards administer under the quality control department workers are supposed to ensure that their individual work meets required specifications (Bunch, 1987c).

A formal quality control program, as noted above, does exist though as Smith and Yang note the program is ineffective. Because of the program's ineffectiveness, "the actual building of ... vessels has not been smooth.... {For a time} Shanghai's Jiangnan Shipyard had only 200 {quality control} inspectors for a workforce of 14,000. The problem of quality control became obvious when the first three sections {of a vessel under construction at Jiangnan} examined were found to have 2,314 faults. {Additionally,} the reliability of the Chinese builders has yet to be firmly established" (Lauriat, 1983, p.165). Because of quality control problems "some 60% of marine materials and equipment to be used to build ships for export must be imported. That is to say, only 40% of marine materials and equipment produced in the PRC can meet the requirements of foreign ship buyers" ("China Industry," 30 March 1983, p.48).

6. Standards

The Chinese have long recognized the value of standardization in shipbuilding. Unfortunately, because of the nation's social and political problems any significant progress in bringing about standardization has been slow. With the end of the Cultural Revolution and China's opening up to western "scientific management practices," China appears ready to make a significant push to standardize her shipbuilding industry.

The following is a Chinese provided summary of standardization in Chinese shipbuilding.

> Prior to 1956 {shipyards used} a mixture of foreign standards. {The effectiveness of these standards was weakened by the} individual production methods {used} for single ships and single machines. At that time several enterprises began 'standardization,' but this was fairly decentralized and lacking in central leadership.
>
> In the period following 1956, growth of our national shipbuilding industry was quite rapid because it was already clearly seen that it would not do to not standardize. Overall standardization in our national shipbuilding industry began in 1956 and continued into 1960. During this stage we depended chiefly on formulating national standards on the basis of foreign standards.
>
> 1961-1963. A reaffirmation of existing standards accompanied by study and formulation of standards suited to the situation in our own country.
>
> The post-1963 period in which standardization work again entered a rather smooth stage of growth. This stage lasted until about 1968.
>
> But between 1968 and 1973, ship standardization work virtually ceased; standardization organizations were forced to disband, large amounts of data were scattered and lost, and most standards personnel went to other occupations {This was the period of the Cultural Revolution}.
>
> The post-1973 period. Thanks to the profound concern of leading comrades on the Central Committee and the State Council and given the efforts of ship standardization work personnel and the support of the broad masses of shipbuilders, ship standardization work once again reached a high tide. In 1973 the All China Ship Standardization Work Conference was convened and established the Ship Standardization Committee, set up a unit for personnel returning to the ship standards profession, approved administrative methods, and formulated a work plan, but though it registered some accomplishments, numerous obstacles prevented its rapid expansion.
>
> The post-1976 period. Thanks to the high regard for standardization work on the part of the party Central Committee headed by Chairman Hua, an excellent situation developed in standardization work, but some problems urgently requiring solution still existed in the development process, most notable how to

> apply 'standardization' to the problem of raising scientific management levels, which urgently required conscientious study and solution (Cheng Tianzhu, 1979, p.37).

Given shipbuilding's suitability to standardization it can be argued that the following five factors will speed up China's standardization efforts.

1. Exposure to western certification institutions like Lloyds.
2. Contracting Japanese firms to modernize Chinese shipyards as has occurred in Dalian and other shipyards.
3. Participating in joint ventures with Western manufacturing firms experienced in standardization.
4. Education of a new generation of Chinese engineers and management at western universities.
5. Exposure to visiting western academics knowledgeable about standardization.

All of these factors work to educate Chinese shipyard management on the value of standardization as well as to help provide a workable means of implementing a standardization program in the industry.

Cheng Tianzhu points out that the Chinese recognize that

> standardization work plays an important role in strengthening management of enterprises, improving quality of output, shortening design time and time required to build and repair ships, in reducing costs, in the organizing and consolidating of specialized production, and in coordinating overall relationships. It promotes the growth of the shipbuilding industry and provides a fairly good foundation for the further development of our national shipbuilding industry (Cheng Tianzhu, 1979, p.36).

The problem, however, as always in China, lies in bridging the gap between recognition and implementation. The management information system is so poor in China that it is hard to properly document standards and then ensure their use. Shipbuilding expertise still depends to a large degree on the personal knowledge and experience of the engineer involved in the project (Bunch, 1987c and Smith, 1987).

This problem existed in 1978 and it still exists today. Statistical data for six shipyards and one design institute that implemented standardization of ship products shows that of the 72.5% items standardized only 27.1% of these items were actually used (Cheng Tianzhu, 1979, p.41). So, although standardization exists in some instances, the production facilities are not using the standardized items in their production.

Partly because of China's failure to standardize its shipbuilding industry, it must import so many of the key components in the ships built for export. China still cannot meet agreed standards for international certification (Muller, 1983, p.183).

7. Joint Venture

Joint ventures are an agreement between a Chinese organization and a foreign corporation for the production of some manufactured good. The joint venture always involves producing the good in China. The target market may be either China or some export market. The arrangement usually involves China opening its domestic market to some foreign firm in return for capital investment in China, technological input, and the training of Chinese workers and management. China provides the area that the plant will be located and the foreign firm provides the capital, advisors and some senior management.

In 1983 China implemented a joint venture law. The law is based on the following guidelines.

1 Foreign equity must be at least 25% with an upper limit of 50%.

2 The chairman of the board and one vice-chairman for the joint venture must be appointed by the Chinese partner. The other vice-chairman may be appointed by the foreign partner (Weele, 1985).

Major joint venture agreements in effect in Chinese shipbuilding involve the production of marine compressors, electric deck machinery, marine steam auxiliary boilers, valve cartridges, hydraulic cylinders, sewage treatment systems, incinerators, fresh water generators, enclosed lifeboats, and offshore mooring equipment.

8. License

License is very similar to joint ventures in that the Chinese receive technological input from a foreign company to start production of some manufactured good. The difference is that under license agreements China essentially buys the technology and permission to manufacture the good from the foreign firm. Under license agreements China may receive plans, capital equipment, advisors, and technical documentation.

Figure 3.4 lists some current license agreements related to Chinese shipbuilding. As this partial list indicates, license agreements play an important role in Chinese shipbuilding.

9. Ship Registration

International registry is critical in the shipbuilding trade because insurance companies will not insure new hulls unless the hulls have some standard of quality. The international classification societies provide that standard.

Description	*Chinese Manufacturer*	*Licenser*
Marine diesel	Dalian Shipyard	Sutzer
	Shanghai Shipyard	MAN-B&W
	Yichang Marine Diesel	SEMT-Pielstick
	Hudong Shipyard	Daihatsu
	Jiangxia Marine Diesel	
	Anqing Marine Diesel	
Exhaust gas turbochargers	Xinzhong Power Machinery	Brown Boveri
	Sichuan Turbocharger	
Flexible couplings	Sichuan Marine Gearbox	Dr Ing Geislinger
Marine gearboxes	Sichuan Marine Gearbox	Lohmann & Stolterfoht
Marine alternators	Wuxi Electical Machine	Siemens Aktiengesellschaft
Switchboards	Shanghai Navigation	Terasak Electrical Co.
Hydraulic pumps and motors	Wuhan Marine Machinery	Ishikawajina -Harima
Deck cranes	Nanjing Marine Auxiliary	Liebherr

Source: "Chinese Yards," 1984

Figure 3.4 Chinese Shipyard License Agreements.

The classification society sets the standards in workmanship, quality control, and material standards for each class of ship that it registers. The society conducts periodic inspections in these different areas to ensure compliance with the standards.

The Chinese accept the buyer's ship registration requirements. This means they open their production process, sources of raw materials, and completed ships to inspection by international ship classification societies like Lloyds Registry and the American Bureau of Shipping. These organizations will maintain offices at shipyards requiring vessel certification. From these offices, the societies conduct independent inspections of the production process.

The classification societies have contributed significantly to improved quality and advances in the design, construction, maintenance, and operation of ships. The world classification societies go beyond simple ship certification. They have a strong track record for sharing their knowledge and cooperating with the shipyards they work with as well as with the domestic classification societies (Walker, 1985, p.12).

China only began certifying ships after it began exporting (Muller, 1983). This occurred because China does not have the same insurance demands that other ship owners have. The government essentially owns and self-insures all Chinese ships and was in a position to absorb any loss that might occur due to faulty construction.

Now, however, the Chinese have formed their own ship classification society named ZC. Although little information is available on the society, ZC is believed to be structured along the same lines as the major international ship classification societies. According to Mr. Li Kojun, the deputy general manager of ZC's overseas department, an important goal of ZC is

> to foster closer relations and encourage information exchange programmes and business co-operation agreements with other societies.... 'ZC has established good arrangements with the major world classification societies, but we want to emphasize these more and extend our links to all classification societies around the world.'... The ultimate objective is to ... ensure {ZC} has service facilities ... around the world to assist owners who have classed their vessels with {ZC} (Bishop, 1986, p.3).

Requests for ZC approval of foreign parts supplied to Chinese shipyards has been strong as many overseas manufacturers and suppliers vie for a share of the ship component market (Bishop, 1986).

China realizes at least two things from its classification society. First, it puts China on more of an equal footing with the other shipbuilding powers who have their own classification societies. It gives China a little more legitimacy in the shipbuilding/ownership arena, or at least China perceives that it has that legitimacy. Second, it helps China orient her work force toward thinking in terms of quality and inspections. By running their shipyards through the Chinese registry, those shipyards are a little better prepared to face the experienced eye of the international classification societies.

10. Shipbreaking

Shipbreaking is an important area because of its potential as a source of raw materials and second hand marine equipment.

Shipbreaking involves the purchase of old, obsolete, or damaged ships to be dismantled as scrap. A ship purchased to be broken can provide a large amount of scrap steel that can be re-rolled or melted into new steel. Additionally, the non-ferrous metals from the ship can also be remelted and reused for new construction. Motors and generators removed from the ships can be used on land, in the ship repair market, or for new construction vessels as can other second hand marine equipment. Shipbreaking is also important in that it helps remove any world overtonnage that may exist.

In the past few years China has rapidly risen to become a world leader in the shipbreaking industry. China is the world's leading breaker of dry cargo vessels and is second only to Taiwan in overall breaking tonnage (Brewer, 1986). China has the necessary prerequisites to be a world shipbreaking leader, a vast pool of manpower and a high demand for steel and second hand marine equipment.

China also has a critical need for steel throughout its economy ("Demolition," 1985, p.9) because it has had great difficulty producing consistently good batches of steel (Zhang, 1987 and Smith, 1987). Obtaining steel from shipbreaking helps to solve this problem. Shipbreaking provides China with a steady, reliable, and relatively inexpensive supply of quality steel.

China can use that steel for domestic shipbuilding but not for export production. The reason for this is the standard of quality of the re-rolled steel. Because China has significant quality control problems classification societies will not certify steel China gets from breaking (Smith, 1987).

E. FINANCIAL CONTROL ELEMENTS

1. Budgeting

Shipyard budgets are made on two different levels. On one level the CSSC Beijing offices determine the overall level of production for each shipyard. Additionally, to a large degree, they specify each shipyard's sources of domestic and foreign raw materials. The CSSC also determines each shipyard's customers (Sensenbrenner, 1987, p.35). For large or special foreign orders CSSC headquarters in Beijing and the Bank of China may become involved in the specific budget for that

particular order. Bank of China involvement occurs when the order requires intricate financing or if the customer is determined to be high risk (Bunch, 1987b). But once level of production, source of raw materials, and customers are determined the shipyard writes its own budget within those constraints.

At the other level the business department takes the lead in shipyard budget formulation. The business department develops a 'target cost' by estimating all the costs involved in each order. A target cost is based on man-hours and materials. The man-hours are estimated on the basis of tonnage and are adjusted by dimension and shape 'adjustment factors' for each ship (Bunch, 1987b). A target cost exists for each order. This cost is the sales price less profit and taxes. The business department acts, to a large degree, independently in estimating job costs. It relies on internal historical records to determine its estimate and uses little input from other departments. At times other departments are consulted in the estimate formulation, but this occurs rarely (Bunch, 1987b).

The shops operate on the basis of a budgeted cost derived by reducing target cost by some percentage. Top management in the economics, accounting, and finance departments are responsible for the final cost allocated to the shops. Production department has no say in cost allocation (Bunch, 1987b).

Budgeted costs are allocated for contingency. They are a device to help keep each shop from exceeding its true or target cost. Because the budgeted cost is less than target cost the budget has built in negative slack. "If a department or shop overruns its budget cost additional funds are given to the unit from the contingency account" (Bunch, 1987b). An investigation into each departmental overrun is performed. If it is determined that the budget was exceeded because of a worker's mistake, the worker is required to make the correction on his own time and without additional pay. If the overrun is the result of management action or inaction, no punishment is applied to the management. On this particular dimension there does not appear to be incentive for management to perform to budget.

A weakness in the budgeting process is the lack of accurate estimation and allocation of overhead and indirect costs. Good historical records on indirect costs have not been kept. However, the shipyards have been moving to improve the accounting of costs by installing modern computer systems to keep track of their costs. Hudong shipyard just acquired an IBM 4130 computer to try to improve its accounting system in this area (Bunch, 1987b).

2. Accounting System

The Chinese use a fund accounting system in which they combine elements of cost and financial accounting. Fund accounting is used principally by public sector ventures as a control device to help ensure that monies allocated are spent for their intended purpose (Farrell, 1987). The Soviets originally brought fund accounting to China (Farrell, 1987).

The shipyards manage each job on the basis of a job order cost system. For each project the shipyard records the direct labor and materials necessary to perform the job. Overhead costs are added in on the basis of direct labor costs. Overhead cost is defined as 'workshop overhead' and does not include any management or administrative expenses. This cost is about 100% of the direct labor cost (Yang, 1982, p.11). Yang points that "Workshop overhead is more or less connected with shipbuilding production. It includes the following: workshop real capital property, such as buildings, productive equipments, workshop transportation tools, ; a discount charge; water and electricity; interest" on cash used by the workshop; and other items (Yang, 1982, p.14).

A final category of costs, which does not include workshop overhead, is indirect costs. Indirect costs include all shipyard administration costs, including indirect production costs and worker social costs. Indirect production costs include production planning, production management, quality control, supplies, and management salaries. Worker social costs include expenses for worker well being (including mess expenses), safety expenses, environmental protection, death benefits, health services, natural catastrophe damage assistance, labor insurance (including retirement), education and training, and safety planning costs.

Indirect costs are set by management for each accounting period on the basis of past experience and future expectations. Variances between the expected and actual values are then adjusted to reflect actual experience (Yang, 1982, p.14). These costs usually run about 150% of direct labor costs (Yang, 1982, p.11).

The accounting system becomes managerial through the use of a shift accounting system. The shift accounting system uses a chalkboard at the workshop level to show 1) key performance areas, 2) standards and targets for each area of performance, and 3) the workshops actual performance record (Flamholtz and Farrell, undated, p.11). The chalkboard is actually placed on the floor of the workshop for all the workers to see throughout the day. The chalkboard continuously reminded the workers of their goals and performance to date (Flamholtz and Farrell, undated, p.13).

Data from all of the workshops are collated and combined into the financial reports that are sent to the regional CSSC office and then onto the central office in Beijing (Bunch, 1987c and Flamholtz and Farrell, undated). Under the fund accounting system the central and regional offices can quickly see how well each of the funds are being used and determine if they are going to their intended purpose. The use of the special income statements allows the central and regional CSSC offices to conduct their own variance analysis on the shipyard to improve performance and determine future budgeting. On a local level and on the headquarters level the shipyard accounting system combines both managerial and financial accounting characteristics (Bunch, 1987c).

3. Financial Statements

The balance sheet, income statement, and special income statements are the principal financial statements used in Chinese shipyards. Each of these statements is prepared by the shipyard for external reporting to the head CSSC office in Beijing. The statements are 'used to provide information in evaluating the performance of an entity in relation to plans and targets. These statements comprise, in other words, the measurement component of a control system" (Flamholtz and Farrell, undated, p.14).

In the United States and western countries financial statements are used to relay information about an organization's operation to that organization's owners. In China, financial statements are also used to relay information to the organization's owners--the government. But in China the government also has more say in organizational planning. Consequently, financial statements in China must facilitate that planning function.

The financial statements are designed to feed planning information up through the planning hierarchy (Farrell, 1987). Accounting experts Flamholtz and Farrell outline the different financial statements used in Chinese business.

> The financial statements are designed to highlight things {the government} consider important (Farrell, 1987).
>
> The balance sheet provides information about actual funds and resources available to the enterprise for use in comparison against 'norms' for financial resources.... The data in the balance sheet is used to determine whether the enterprise had the appropriate amount of funds, required additional funds, or had excess funds (Flamholtz and Farrell, p.14).
>
> The income statement provides information for use in determining variances from planned and profit targets (Flamholtz and Farrell, undated, p.14). The

income statement serves as a starting point for special income statements. The special income statements can be thought of as budget sheets. They are used to compare actual revenue and profits with planned targets. Variances are calculated from these statements (Flamholtz and Farrell, undated, pp.14-15).

The Chinese do have a set of uniform accounting principles that govern the preparation of their financial statements. These principles are divided into two categories, a uniform set of standards and a uniform set of disclosures. Both are dictated by the government. In a major industry like shipbuilding those standards are, for the most part, probably adhered to, though the Chinese do not have a strong enough structure to ensure that these accounting standards are adhered to across the board (Farrell, 1987).

4. **Finance**

Finance can be broken down into two general areas: shipyard finance for capital acquisitions and the capital to finance each shipbuilding project. Each is critically important to the well being of the shipyard. Without a source of funds for capital acquisitions, the shipyards would be unable to modernize and would lack the equipment and tooling required to build ships in a competitive fashion.

Project financing applies principally to the buyer. Normally, shipyards do not engage in speculative building. The shipyard only begins a new project after it has a firm contract. But project financing is a major shipyard concern in that if buyers are unable to secure financing to purchase ships, shipyard orders will fall and the yards will sit idle, absorbing heavy losses due to fixed costs (*Lloyd's List*, 1986).

a. Shipyard Financing

Chinese shipyards have four sources of funds for capital acquisitions:

1. net after-tax shipyard income
2. capital supplied by the CSSC/state
3. bank borrowing
4. capital supplied though joint ventures (Bunch, 1987c).

Acquisitions from cash flows (after tax income) and bank borrowing are treated in the same way that such transactions are handled in the west. For cash purchases an asset is debited and listed on the balance sheet and cash (or its equivalent) is credited. For bank loans, the loan is listed as a liability and a schedule of payment is arranged for both principal and interest (Bunch, 1987c, p.3). Terms of most loans are very generous. Recent loans have carried a 2.52% annual interest rate with repayment over a three year period (Ma, 1983, p.108).

Depreciation of assets is used in China with depreciation charges made against net income. Straight line depreciation is the most commonly used method of depreciation (Yang, 1985, p.1).

The Bank of China is a frequent source of loan capital. Additionally, regional trust companies have formed throughout China to help provide funds for capital financing. Regional trust companies tend to provide smaller loans but are important in that they help "open up diversified channels for sources of funds" (Li, 1985, p.40). This loan source is important because it both speeds up loan processing and reduces the competition for smaller, more regional borrowers. Li states that "investment trust companies may be organized according to regions or industries or trades" (Li, 1985, p.40). The Dalian Municipality Investment Trust Company is one regional trust company that has been extremely successful as a new source of capital for expansion and modernization.

Capital supplied by the CSSC and the state is treated "as an infusion of equity funds and no repayment is required. To get such an investment, the enterprise is required to submit a plan showing how the investment will increase profits, and return on investment to the CSSC/state" (Bunch, 1987c). Of course, the more attractive the enterprise can make the investment look, the greater the chance it has of getting the funds. The CSSC does have criteria that it uses to allocate such investment funds with "return" or "interest on money" an important consideration. Another criteria includes the relative importance of the enterprise (Bunch, 1987c).

The government's attitude towards capital infusions to enterprises is highlighted in the following quote from Li, "insufficient funds constitute a serious problem in the carrying out of technological transformations. The state will provide the necessary financial support to the technological transformation of the old industrial bases, but it would not be possible to depend on state support alone since, in reality, the state is unable to shoulder the whole burden" (Li, 1985, p.40).

The final source of financing available to Chinese shipyards is from foreign corporations. In this type of venture China essentially allows a foreign corporation the chance to buy into the Chinese market with technology, training, and facilities (Bussey, 1987).

b. Buyer Financing

For years the world shipbuilding industry has been seriously hurt by a glut of overbuilding. In this climate new ship prices have fallen because of significant

financing provided by the builder or the builder's government. Additionally, credit terms have become very favorable to the buyer in an effort to attract new orders. For any nation to seriously compete in the world market they must conform to this marketing policy of low prices and generous credit (*Lloyd's List*, 1986-1987).

The Chinese conform. Essentially, five sources of financing exist for buyers of Chinese ships. These sources are the Chinese government, the CSSC, the regional shipbuilding corporation under the CSSC, the Bank of China, and foreign banks or financial institutions.

Terms of financing are very similar for all sources. Typically, the financing institution provides a low interest, fixed rate loan that covers 75 to 85% of the shipbuilding contract. A typical arrangement is the agreement negotiated in 1983 between the Bank of China and the Express Shipping Management Company of Hong Kong. In this agreement

> the Bank of China provided a buyer's export credit {to} ... the Express Shipping Management Co.... The credit is to facilitate a U.S. $20 million order for four ships of less than 10,000 dwt each, placed with the Zhanghua Shipyard in Shanghai.... The credit ... covers 75-85% of the shipbuilding contract. The loan is to be based in U.S. dollars and is repayable every six months at 8.5% fixed annual interest over eight years (Ma, 1983, p.108).

In the cases where foreign commercial banks finance new ship construction, the ship price is lowered to the level where the higher cost loan is evened out by the reduced price of the ship (Bunch, 1987c, Smith, 1987, and Zhang, 1987). The ship prices in this instance have to be lower or else the buyer would go elsewhere. The market belongs to the buyer.

F. SUMMARY

The purpose of this chapter has been to give the reader an idea of how Chinese shipbuilding operates through its control system. The idea of behavioral control linked to the achievement of the organization's objectives has been emphasized by grouping control elements into the categories of organization, quality control and productivity, and financial control. As mentioned earlier, selected control elements from these categories, especially those in quality control and productivity, are discussed further in Chapter V to demonstrate how resource dependency and institutional models can be applied to shipyard control system evolution. Hopefully, an understanding of the current shipyard control system will make a study of the evolution of that system more clear.

IV. TWO ENVIRONMENTAL PERSPECTIVES ON CONTROL SYSTEM DEVELOPMENT

Three issues have dominated the Chinese shipyard control system: shipyard management concern for its survival, effectiveness in operations, and efficiency in operations. These issues have served as the motivation for shipyard management in their approach to the shipyard control system. These issues have had a direct bearing over the type of control system the shipyards have established as well as the management support for and use of that control system (Bunch, 1987d and Muller, 1983).

At times the issues have overlapped, as during the Cultural Revolution. Because purges swept the country shipyard, management was eager not to draw attention to itself. The shipyards seemed content to maintain domestic production quotas with little concern for either the efficiency of their operations or the quality of the goods produced. Shipyard management seemed to see that by being effective, by maintaining a consistent output, they would not draw unnecessary attention to themselves and thus stood the best chance of avoiding a purge.

1. Concern For Survival

Since the communists took power in the late 1940's the country has undergone three major periods of political, economic, and social upheaval and numerous other smaller attacks on rational change. The three major periods were the Hundred Flowers Campaign, the Great Leap Forward, and the Cultural Revolution.

During these periods different segments of Chinese society were subject to intense verbal and at times physical attack. "Worried that economic reforms will make their political skills obsolete and diminish their power, party officials often fail to implement the reforms or even attack them for deviating from political orthodoxy" (Kim, 1984, p.67). The shipping and shipbuilding industries were directly affected by such attacks. In the mid 1970's we see several examples.

In 1974 the cargo ship, Fengqing, was completed in a Shanghai shipyard. Muller points that "the ship had problems in its sea trials, evidently due to the poor workmanship endemic during the period" (Muller, 1983, p.180). The Ministry of Communication decided not to put the ship into long-distance international service because of doubts as to its mechanical reliability. In response to this decision, more

radical Chinese communists attacked the ministry, accusing it "of such offenses as 'exercising comprador bourgeois dictatorship'" (Muller, 1983, p.180). The ship was put into service.

About one year later, the radicals again struck in the shipbuilding structure. "The radicals caused a certain degree of unrest {between workers and management} as workers were encouraged to feel outraged at alleged competition from foreign imports. Propagandizing the shipyard workers ... {provided} ever a fertile ground for political activism" (Muller, 1983, p.181).

These incidents were not isolated or uncommon. The result was that shipyard management had to be continually responsive to all voices in society, even the more radical and irrational ones. If shipyard management wanted to avoid being purged for failing to follow Mao Tsetung thought, they had to be extremely careful about how they acted. Often, the most common defense was to toe the party line and do nothing to make the organization or shipyard standout.

2. **Effectiveness in Operations**

If shipyard management did not want to excel in its work, it had to decide at what level it would operate its shipyards. This decision was made by the Chinese government centered in Beijing. By formulating a national plan that established quotas for all manufactured goods throughout the economy, the State Council was setting the standard for effectiveness in each industry. Kim describes the nature of the plan:

> The centralized structure of the command economy limits the ability of enterprises, localities, or bureaucratic agencies to engage in international business. The national plan regulates almost all activities related to production. Factory managers cannot freely hire labor, raise wages, choose products, set prices, or invest profits in other enterprises.... The national plan ... is enforced by the central planners and industrial ministers (Kim, 1984, p.70).

Output, not quality, was the measure under this system. Additionally, no attempt was made to improve shipyard efficiency. Shipyard managers just had to ensure they met the level of production established by the national plan. This action would best ensure their survival.

3. **Efficiency in Operations**

As long as the input of resources was secure and production quotas were not set too high, the shipyards did not have to concern themselves with efficiency. The Chinese government helped the shipyards in ignoring efficiency by emphasizing heavy

industry over light industry and agriculture (Kim, 1984, p.60). The expansion drive in heavy industry "was unconstrained by calculations of the cost of capital, labor, or other inputs, {and} created constant supply shortages. These shortages motivated enterprises to guarantee their supply inputs through vertical integration and led provinces to strive for local self-sufficiency. As a result, levels of inter-regional trade were low. The Chinese system also created national economic monopolies, each headed by a ministry (Kim, 1984, p.60). Kim points out the effect the monopolies had. "The ministries were able to control quotas to easily achievable levels. Additionally, because of the monopoly, the enterprises 'had little incentive to reduce their costs, raise productivity, or improve the quality of their products" (Kim, 1984, p.60).

As long as the monopolies existed and the central ministries controlled profits, efficiency in operations was not an issue. Operational efficiency became an issue when the monopolies changed, however. This occured when China entered the international shipbuilding market and when local shipyard managers were given the incentive for improving efficiency, as under the factory director responsibility system (Bunch, 1987d and Muller, 1983).

These key issues motivated shipyard management thinking as it directed their shipyards using the control system that was set up by the central ministry. Two separate theoretical perspectives on organizational control can be used to explain why these issues led to the control systems that evolved in the Chinese shipyards. The two perspectives, resource dependency and institutional, are explained in this chapter. The next chapter will explain how the issues above could motivate Chinese shipyard management to follow courses of action that can be explained by the two perspectives.

A. RESOURCE DEPENDENCY PERSPECTIVE

All organizations are in competition for resources. These resources can be *raw materials* --the steel, alloys, metals, and other materials needed to build ships; *skilled labor* --the engineers, architects, welders, or machine operators; and *capital* --the money needed to finance a project or the capital machinery needed to support operations. Or, the resources can be anything else that an organization must obtain and then use to produce a product or to perform a service.

The degree of difficulty that the organization has in obtaining its factors of production--that is the level of competition for these resources--will influence the type of organizational structure and control system that the organization sets up to obtain and then to manage these factors of production.

The more difficult a resource is to obtain, the more competition that exists for any given input to production, the greater the effort the organization will make to obtain that input or to obtain some suitable substitute. Additionally, the means of controlling that resource will be more elaborate (Pfeffer and Salancik, 1978). This reasoning is supported by Tolbert: Each organization's "need to ensure a stable flow of resources from external sources of support partially determines administrative differentiation" (Tolbert, 1985, p.1). This perspective of organizational structure and behavior is called the resource dependency perspective.

The view that an organization's structure and personality will be significantly affected by the level of competition for its resources can be applied to the shaping of the Chinese shipyard control system. The resource dependency perspective is useful in explaining why Chinese shipyard management took the shape that it did.

At first, research in the area of the source of growth in administrative components of organizations focused on factors such as size and complexity as impeding the efficient operation of the organization. Tolbert (1985) tells us that focus has changed with recent work placing greater emphasis on environmental relations and influences than on internal relationships as determinants of administrative structure. According to Tolbert (1985), classic organization theory emphasizes problems of coordination and control of work activities in explaining the formal structure of organizations. The resource dependency perspective "on organizational environments and the way in which environments affect organizational behavior and structure" conceptualizes the environment "in terms of other organizations with which the focal organization engages in direct exchange relations" (Tolbert, 1985, p.1). The environment is an important part of any resource dependency perspective.

1. **The Environment**

Resource dependency is an environmental perspective (Pfeffer and Salancik, 1978, p.258). To understand any organization from this perspective, one must first understand the environment in which the organization operates (Pfeffer and Salancik, 1978, p.12). Pfeffer and Salancik identify three levels in the environment that help one understand how an organization's environment affects that organization. These are the levels:

1. The first level of "the environment consists of the entire system of interconnected individuals and organizations who are related to one another and to a focal organization through the organization's transactions" (Pfeffer and Salancik, 1978, p.63).

2. "The next level is the set of individuals and organizations with whom the organization directly interacts" (Pfeffer and Salancik, 1978, p.63).
3. "The third level of the organization's environment can be characterized as the level of the organization's perception and representation of the environment--its enacted environment" (Pfeffer and Salancik, 1978, p.63).

The first level focal organization in this study is the shipyard. Transactions include both obtaining the factors of production and the sale of the finished good, the ship. The individuals are the shipyard employees on the shipyard side, and on the outside, the sales agents, buyers, delivery personnel, government agents, bankers, and so forth, who negotiate and carry out the transactions. If the shipyard experiences problems in conducting these necessary transactions, then the control system must be modified to ensure the transactions are concluded.

For the shipyard, second level units are anyone or any organization that the shipyard comes in contact with, for example the local society in which the shipyard is located or the classification societies that establish standards for ship construction and who then ensure those standards are met. Shipyard management must adjust the control system to reduce conflict with these organizations if they have the ability to interfere with the shipyard's goals.

On the third level, how the environment is seen by the individuals responsible for controlling the organization and planning its activities is a critical component in determining what the environment is. "The events of the world around us do not present themselves to us with neat labels and interpretations. Rather, we give meaning to the events" (Pfeffer and Salancik, 1978, p.72). If elements of an environment are perceived as existing by the people controlling an organization, they will react to that perception to best direct the organization to the goals they want to achieve. This situation applies to Chinese shipyards. At both the national level, at CSSC headquarters in Beijing and at the local shipyard management level, the management apparatus reacts to its view of reality. On both levels, the management works to control the organization to best operate in the environment each perceives. Thus, the enacted environment is an important level in explaining how the organization evolves.

The three levels of the environment help us to understand the different components and forces that combine to influence the organization. Keeping these levels of the environment in mind is important as we discuss more specific elements of the Chinese shipbuilding environment since each level has a different effect in influencing how the organization reacts to the environment.

B. THE INSTITUTIONAL PERSPECTIVE

Establishing a stable flow of resources to ensure the organization's survival is important from both the resource dependent and institutional perspectives. A principal difference between the perspectives is how that flow of resources is established.

The resource dependency perspective sees controls as the means to build an efficient, competitive organization. Because the organization is a strong competitor in the market, the organization will be able to acquire the resources it needs to survive.

Under the institutional perspective controls are a means to achieve legitimacy in the market place. Efficiency is not as important as is the need to be seen as a credible organization. If the organization can achieve legitimacy in the market, the resources needed for continued organizational survival will flow from that legitimacy.

"Institutional theory treats organizations as successful to the extent that they embody societal myths concerning rationality. A societal myth, in this case, is the belief that two (or more) unrelated events are in fact linked" (Euske and Euske, 1986, p.3). An example is the belief that a ship certified by an international classification society is a better ship than an identical ship built by the same shipyard, yet not certified by any classification society. "Through the embodiment of societal myths institutional organizations gain and maintain legitimacy. As a result legitimacy, as opposed to efficiency, is the main criterion for survival and growth for the nonprofit organization" (Euske and Euske, 1986, p.3).

Meyer and Rowan write that the more important it is for an organization to achieve legitimacy in its environment, the more that organization will change its structure to conform with the myths of the institutional environment. The organizational structure will move to "become isomorphic with the myths of the institutional environment" (Meyer and Rowan, 1977, p.340) because the organization sees the established structure as being a legitimate structure.

Arguments can be made that many of the changes in the Chinese shipyard control system are better explained by an institutional rather than a resource dependency perspective. At certain times the Chinese changed their control system for legitimacy reasons. China perceived the need to appear a legitimate shipbuilder and charged their control system to fit that legitimacy image.

Legitimacy can be looked at as a means to effectiveness. One interpretation is that the Chinese seem to feel that if they are seen as legitimate shipbuilders, then world buyers will be more willing to purchase their ships.

Institutionalization is very much a structure building phenomenon. In response to what the organization sees as rationalized institutional rules, the formal organizational structure arises. "The elaboration of such rules ... accounts in part for the expansion and increased complexity of formal organizational structures" (Meyer and Rowan, 1977, p.340).

The process of institutionalization is as follows. The organization pursues an objective. This objective could be just about anything. Let's use a shipbuilder's goal to produce ships in demand on the world market. The shipbuilder knows that he can build ships, but he questions his ability to sell those ships because his organization has never interacted with the world market before. The shipbuilder, in looking at other successful shipbuilders, perceives certain institutional rules that his organization is not following. These rules could be the level and type of training of his personnel, standardization procedures, quality control programs, organizational structure, marketing apparatus, and any number of other organizational facets that his organization does not yet incorporate. Just because our shipbuilder does not meet the institutional rules, just because he does not have the organizational apparatus that the rules demand, does not mean he cannot build a good ship. But, without the prerequisite control structure, both the shipbuilder and the market have no perception of legitimacy with regard to the ship. To be seen as a quality shipbuilder our shipyard must either meet the established rules or find some way to create a new set of rules.

Unless the shipyard operates in a closed environment, it is difficult to establish one's own rules. When an organization tries to enter an established market it is difficult, if not impossible, to change the rules operating for that market to meet the existing organizational structure.

So, to achieve the organizational goal, to be effective, the organization is "driven to incorporate the practices and procedures defined by prevailing rationalized concepts of organizational work and institutionalized in society. Organizations that do so increase their legitimacy and their survival prospects, independent of the immediate efficacy of the acquired practices and procedures" (Meyer and Rowan, 1977, p.340).

The new "institutionalized structure" that the organization builds does not have to be effective for legitimacy to be achieved. Because the organization is acting on a perceived deficiency in structure, once the key environmental elements are satisfied that the "prerequisite" structure is in place then the organization's legitimacy need has been satisfied. In the same respect a very effective, efficient "institutional structure" does

not change things either. The institutional issue is not whether the structure is appropriate, but rather is it believed to be appropriate.

By changing its structure to comply with the institutional rules of the market, the shipyard does not necessarily change the quality of the ship that it builds. Yet, it does dramatically increase the acceptability of the ship in the market. By increasing the acceptability of its output the shipyard will find more buyers, thus increasing its chance of survival in the marketplace.

As organizations change their structures to become isomorphic with their environment, they tend to "decrease internal coordination and control in order to maintain legitimacy" (Meyer and Rowan, 1977, p.340). No longer is the organization primarily structured by the demands of technical production and exchange. Instead, the "structures are decoupled from each other and from ongoing activities. In place of coordination, inspection, and evaluation, a logic of confidence and good faith is employed" (Meyer and Rowan, 1977, p.340). If legitimacy is achieved, the market will have faith that the product is a good product. Put simply, the organization is more concerned with establishing a perceived image of legitimacy then it is with producing a good, quality product that can compete in the market on its own merits. This de-emphasis on rational thought tends to "conflict sharply with efficiency criteria" (Meyer and Rowan, 1977, pp.340, 341). When an organization is placing so much effort into achieving legitimacy and becoming isomorphic with its environment, it is placing the greatest value on effectiveness instead of efficiency. The organization is focusing on remaining a viable organization in terms of its structure. The organizational perception is that it must do what it takes to ensure its survival in the market.

The resource dependency and institutional perspectives will be used to explain the evolution of the Chinese shipyard control system. By properly identifying the environment that existed, we can come to a better understanding of the Chinese shipyard control system through these perspectives. As we look at how each perspective applies to the Chinese situation, the issues of shipyard management survival, effectiveness, and efficiency are important to keep in mind. These issues will help show how the motivation and objectives of shipyard management changed with the market environment in which the shipyards operated.

V. EVOLUTION OF THE SHIPYARD CONTROL SYSTEM

A. GOALS, ENVIRONMENT, AND CONTROL SYSTEMS

Understanding the shipyard control system requires knowledge of both the principal goals of the organization and the environment in which the organization will operate. The shape the control system takes depends on what the organization wants to achieve and the obstacles the organization sees it must overcome. What the organization wants to achieve constitute the goals of the organization: one set of obstacles is a function of the organization's environment.

This chapter describes the evolution of the Chinese shipyard control system by examining the control system changes the shipbuilding industry made to best achieve its goals and overcome obstacles. Why specific control system changes occurred is illustrated by describing these changes in the context of the resource dependency and institutional perspectives.

This chapter discusses the control system that developed in each of three distinct periods. The paper highlights how each period's control system was different, instead of trying to describe each period's system in complete detail. Only the control elements that most dramatically illustrate the change in organizational goals or environmental change are analyzed.

Since a control system is so dependent on both organizational goals and the organization's environment, attention will be given to identifying these two aspects in each period. Throughout, the link between goal and environment is made using either the resource dependency or institutional perspective.

B. EVOLUTION OF THE CONTROL SYSTEM

The evolution of the shipyard control system can be divided into three major periods. The first period, which started in about 1949 following the end of World War II and the Chinese Civil War, is characterized by Soviet influence in the industry and by the rebuilding of the shipyards following wartime destruction. During the second period from about 1960 to 1981, China broke relations with the Soviet Union and built ships for domestic consumption only. The third period runs from 1981 to present and is characterized by China's entry into the world shipbuilding market. This period consists of both domestic and export ship construction.

C. PERIOD OF SOVIET INFLUENCE

1. National Concerns

Economic development has always been the primary goal of the Chinese government. The Chinese not only saw economic performance as having a direct impact on the welfare and stability of the Chinese population but it also saw a strong economy as being critical to establishing China as a world power (Barnett, 1974, p.117).

In that context the communist government's first and most important goals were to build a strong industry, maximizing the rate of industrial growth (Barnett, 1974, pp.121-122). Barnett emphasizes this point.

> The Chinese Communists have created for themselves a vision of China crowded with roaring steel machines, belching smokestacks, and blue-clad industrial workers. They aim to 'transform China into a powerful, industrialized socialist state,' and to create a 'great socialist industrial country and one of the most advanced in the world.' To them, modern industry is the symbol of complete independence, national power, and economic improvement.
>
> Not only are the Communists determined to carry out the industrial revolution in the world's largest agricultural country; but, they insist on trying to do it at a frantic pace, and the 'socialist industrialization of the USSR is their model. They point to the Soviet Union, contrasting its industrialization in 'ten to fifteen years' with the larger periods required for industrialization ('fifty to a hundred years') in Western countries, and they proclaim that China has decided to 'travel the road of the Russians' (Barnett, 1964, p.234).

But World War II and the Chinese Civil War left the Chinese industrial base in shambles. A significant portion of the industrial plant was either destroyed or was removed by the Soviet Union as they withdrew at the end of World War II (Fairbank, Reischauer, and Craig, 1978, p.907). The capital equipment that did remain, as well as the physical plant, was aging, damaged, and neglected. Chinese industry was in need of significant repair and modernization (Muller, 1983, p.61 and Barnett, 1964, p.235).

However, China did not have the economic infrastructure to support any major industrial effort. China lacked the managers and engineers with the necessary technical knowledge to bring heavy industry to China. China did not have the capital equipment or machine tool industry to support industrialization. China was too backward to have any real hope of rapidly building her own shipbuilding industry.

Before the war China was not a major world industrial power. China was largely an agrarian nation with a strong handicraft element (Lindbeck, 1971, p.195).

About the only thing China could throw into an industrialization effort was a huge, but untrained, labor force. For China to modernize and bring heavy industry into the country she would need help in the form of training, capital, machinery, and management expertise from abroad. The Soviet Union became the source of these critical resources.

The resource dependency perspective tells us that the more difficulty an organization has in obtaining its factors of production the farther that organization will go in its efforts to obtain that input (Tolbert, 1985). In this period Chinese industries, including shipbuilding, did not have their own means of obtaining any substantial amount of production resources. For this reason they were willing to accept whatever resources the Soviets would supply to build their industry as well as establish whatever control elements were necessary to ensure this assistance (Muller, 1983).

2. Shipyard Concerns

When the Soviet Union first became active in Chinese shipbuilding, the issue was simply if the Chinese could build ships. Muller points out that "the first merchant ship built in China after the communist revolution" was not completed until 1955 (Muller, 1983, pp.58, 59). The Chinese needed someone to show them how to build ships as well as to set up sources of raw materials. The shipbuilding organization's survival was in question. Top priority was making the yards operational again.

3. Control System Changes: Shipyard Organization

A large part of what the Soviets provided was the control system used to manage the rebuilt and modernized shipyards. Since China was starting with a dismantled shipbuilding structure (Muller, 1983 and Zhang, 1987), the first step in making Chinese shipyards operational was to build the shipyard organization. The direction, capital, planning, engineering, and models for shipyard rebuilding and expansion all came from the Soviet Union as did the advisors, designs, equipment, and parts to keep the shipyards operating (Muller, 1983, pp.61, 90).

During the period of Soviet influence, the Chinese had not yet learned enough about shipyard management to structure their own control system. The Chinese were too busy rebuilding their shipyards, getting ready for initial production to worry much about what was the best control system to implement in this period. It appears that the Chinese were content to use Soviet provided control if it moved China closer to her goal of initial production. Consistent with the resource dependent perspective, the organization was allowing administrative differentiation to occur in order to ensure the stable supply of Soviet resources.

One can think of the Soviet inputs as constrained resources vital to the survival of Chinese shipyards. The control elements were actually resources to be used by a China poor in these particular resources. At this early point in Chinese shipbuilding, China was acting to establish initial control over the industry. The Chinese were concerned with gaining control over the conversion process (the conversion of raw materials into ships) as a first step in managing the industry. The following discussion talks more about China's shortage of these basic control elements or "resources." The discussion centers on facilities, organization, planning, and management.

New shipbuilding facilities in China would give the shipyards the physical capability of producing ships. This meant outfitting each shipyard with the capital goods such as dry docks, slipways, fabrication shops, cranes, and wharf facilities needed for ship production. Beginning with the first five year plan in 1953, construction of these new facilities began. Advice on construction was provided by Soviet advisors (Muller, 1983, p.61) and "by the end of the decade {1960}, China's facilities for the construction {and} repair ... of merchant shipping had improved remarkably (Muller, 1983, p.62)."

At the same time the Chinese were rebuilding their shipyards under Soviet direction, a similar effort was underway throughout Chinese industry. This was especially true in the heavy industries, like iron and steel where the Soviets provided significant support (Lauriat, 1983, p.74). This development was important because these industries would form the supply base of raw materials for the shipyards. Also their proximity to each shipyard would influence the control system that came into existence in the period of domestic production. What was unique about these industries is that a circle of related industries sprang up around each shipyard. While this led to some duplication of facilities, a self-sufficiency was created in each shipyard that was consistent with the Soviet example. The Soviet shipyard model had each shipyard surrounded by a circle of supporting industries like steel plants, design institutes, instrument plants, and training institutes. The idea was to make each shipyard as independent as possible so that a breakdown in transportation or trouble in a separate region would not disrupt the operation of separate shipyards (Butman, 1987).

Although the Chinese achieved production capability, the ships they were launching were largely the result of Soviet technology and expertise (Muller, 1983,

pp.58, 59). The Chinese shipyards were actually being run by the Soviet advisors using Soviet input. As the Soviets kept the shipyards operating, they slowly trained the Chinese in the skills necessary to handle ship production independently (Lauriat, 1983, pp.16-17, 86 and Muller, 1983, pp.58, 59). Chinese expertise was distilled from Soviet expertise. The Soviet advisors comprised the initial management structure of the shipyards while the Chinese managers appointed to run the shipyards watched and learned.

A higher level of enterprise management affecting shipyard control also existed. This level came in the role played by the state government. Government control included negotiating with the Soviets for additional shipyard input, setting the price and supplier of raw materials, appointing shipyard management and the political officer, and marketing output.

The Chinese consistently enacted control measures that would ensure the flow of resources needed to get China going in shipbuilding. The industry's organization building led to exchanges and an administrative structure that would keep a steady supply of production inputs. Chinese control system changes, supported by the Soviets, carried the industry through all three environmental levels identified by Pfeffer and Salancik (1978). The paper looks now at the results the organization achieved.

4. Results

By 1960 the shipbuilding industry under Soviet leadership, modeling, and economic assistance had made considerable improvement from where it had started in the late 1940's. A solid foundation had been laid in the industry, and the repaired and expanded shipyards had begun turning out modern merchant ships (Muller, 1983, pp.67, 68). By relying on a Soviet run control system, the Chinese had, by the late 50's, begun to develop more confidence in their shipbuilding ability. With the Great Leap Forward in 1958 came a new emphasis on not just building modern ships but in building ships in an efficient manner.

Muller quotes Chinese rear admiral Deng Zhaoxiang (August 1958) on improving shipbuilding efficiency:

> Deng Zhaoxiang declared, that the navy, inspired by the Great Leap, had greatly increased its technical training, research and development and was economizing in order to use its allocated funds more efficiently. The mass line was interpreted to mean the use of shipyard workers' and sailors' suggestions for better and cheaper ways of building, maintaining, and operating ships. Deng noted in one example that crews had begun repairing their own ships outside of drydock thus saving money and increasing ship availability (Muller, 1983, p.75).

The Chinese were highlighting the navy's self-repair program as a means to emphasize its political and production record. This increased emphasis on efficiency marks a shift in the industry's attitudes, from the immediate concern of establishing a production capability to the next logical step of making the production process as strong as possible by improving efficiency. For the first time the Chinese had progressed to the point where they could tailor shipbuilding controls for efficiency instead of just establishing the initial operation. They could now emphasize the fact that resources were constrained and continue their progression towards maximizing the output from their resource inputs.

D. THE PERIOD OF DOMESTIC PRODUCTION

In 1960 the shipbuilding environment in China changed dramatically when China severed its relations with the Soviet Union. Soviet withdrawal caused a major setback in the industry. In less than a year the Chinese went from a shipbuilding nation to a nation lacking the ability to build ships. Additionally, the withdrawal destroyed the environment that Chinese shipbuilding had operated under for the previous decade and removed the key elements of the shipyard control system-- the Soviet advisors and the resource inputs-- that were keeping operations going. The withdrawal brought virtually all Chinese naval construction to an abrupt halt (Muller, 1983, p.89).

The Chinese were left with an organization that could make shipbuilding decisions yet whose decisions were meaningless since the local shipyard managers did not have the ability to carry these decisions out. The central government could tell the individual shipyards that they wanted a certain ship built, but the shipyard control system lacked the ability to carry out this tasking since ship design and critical components had all been supplied by the Soviet Union. When this source of input was removed, the established control system was not able to generate alternative sources of input. The Chinese lacked the technical ability to design ships themselves and had not yet established the ability to domestically produce ship components. The control system did not fail; rather, both it and the resource supply system were disabled by the Soviet departure. What the Chinese did not realize was the extent to which the Soviet advisors and resource inputs had become part of the shipyard control system.

The Chinese had to rebuild their control system inputting Chinese know how, management, planning, and their own sources of resources into the void the Soviet departure had left. They had to adapt the control system to fit the new environment they had created. The route they followed can be explained by again using the

resource dependency perspective. Resource dependency sees organizational survival intimately tied to resource availability (Pfeffer and Salancik, 1978, p.258). As noted above, the Soviet withdrawal threatened Chinese shipyard survival because it removed the supply of resources. This situation could have been avoided if China had been able to establish stronger controls over her resources from the start. China took this lesson with her into the period of domestic production.

From the resource dependency perspective, one might expect to see strong elements of resource control in the new Chinese system. As we see next this strong central focus on resource control did hold for China throughout the period of domestic production.

1. National Concerns

Once again during the period of domestic production (1960-1980), China's concern was putting together a control system that could be effective, a control system that could generate all the inputs of production needed to meet domestic consumption. For a second time China had to re-establish basic organizational control elements. Muller describes the approach the Chinese took to implement new organization, planning, and management control elements.

> While the output of ships came to a standstill during the early 1960's the Chinese were busy developing the technological and organizational foundations for a shipbuilding industry not dependent upon foreign sources of design or components. The most visible of these developmental measures were the teams of shipyard managers who travelled to Western Europe to study modern shipbuilding techniques and shipyard design. There were also behind-the-scenes domestic development effort under way, which began to pay off by 1963. In that year, the Sixth Ministry of Machine Building was established as a separate ministry responsible for shipbuilding (both merchant and naval), drawing together most of China's maritime construction assets into a coordinated effort (Muller, 1983, p.118).

The experience with the Soviet Union convinced the Chinese that the proper way to develop an industry was to take technical expertise from more developed nations like Western Europe, then use that new expertise domestically to provide all inputs of production-- steel, components, labor, and design. If the Chinese managers could be taught how the raw materials could be combined to produce ships, then the central government could coordinate the supply of resources to each shipyard.

To this end the following changes occured in the shipyard control system. The shipyards were brought under greater central government control by the

establishment of the Sixth Ministry of Machine Building. Sixth Ministry control functions included:

1. Assignment of all raw materials for production.
2. Setting production quotas and specific assignments at each shipyard.
3. Control over any profits generated by any shipyard or marine industry.
4. Appointment of all key shipyard personnel including the shipyard director and the shipyard political officer.
5. Control over the education and training of shipyard personnel, specifically determining exactly what education each shipyard manager would receive.
6. Assignment of all shipyard output to a specific buyer and set price paid.
7. Allocation of shipyard funds through a fund's accounting system.

(*Almanac of China's Economy*, 1984, Bunch, 1987d, and Zhang, 1987).

The change in environment shifted shipyard control from the Soviet advisors who had been acting through the puppet Chinese shipyard control system to a real Chinese control system that operated out of and which kept its base of power in Beijing at the Sixth Ministry of Machine Building. The key principle behind this system was that all major planning would occur at the ministerial level of the central state government (Butman, 1987). State control over the organization came through the principal functions of the Sixth Ministry listed above.

Pfeffer and Salancik argue that "when the resources necessary to achieve coordinated action are widely dispersed, organizations will attempt to use the larger social power of the state to benefit its operating environment" (Pfeffer and Salancik, 1978, p.222). What happened in China was slightly different. In the case of the Chinese shipyards the Sixth Ministry of Machine Building intervened, and in trying to pull together widely dispersed resources, made strong, active use of social power to create a control system that could solve the resource problem the Soviet withdrawal created. The difference lies in that the state was the active force behind the control system changes. Instead of waiting for the organization to solicit state support as Pfeffer and Salancik argue, the state acted independently to secure the resources for the shipbuilding industry because it was the organization. But the important point is the resource dependency perspective consistently explains each control system change. Where organizational survival had again been threatened by a resource limitation, the organization moved to establish new controls to relieve that resource limitation. Again, the results show the shipbuilding industry successful in their goal of achieving basic shipbuilding ability.

The Chinese were successful in shifting the shipyard control system from one dependent on external expertise to one concerned with domestic control over resources. In 1964, domestic shipbuilding know-how had increased to the point where the first All China Symposium of Shipbuilding Technology was held. This Symposium brought together the representatives from 92 institutes and other shipbuilding related organizations. The conference was held to assess current abilities and to lay down tasks for future shipbuilding developmental efforts. The assessment was that by 1964, the Chinese had achieved enough progress towards "self-sufficiency that 85% of the machinery and 90% of the specialized steel required for ship construction" (Muller, 1983, p.118) could be domestically produced. By 1964 China had resumed building ships, completing five vessels that year.

Problems still existed, however. The Chinese continued to lag in technological know-how. They especially lagged in engine production. China lacked the ability to produce engines large enough to power oceansized merchant vessels (Muller, 1983, p.118). In fact, the Chinese built some vessels that sat idle for up to six years awaiting engine installation.

2. Shipyard Concerns: A Different Perspective

While the national government was concerned with re-establishing the ability to build ships without Soviet assistance, local shipyard management was concerned with surviving purges. The Hundred Flowers Campaign and the Great Leap Forward showed the intellectuals and organizational managers in China how vulnerable they were to purges by the state government. Chinese shipyard management, like management throughout China, wanted to avoid such purges. How such motivation affected control over their organizations can be explained from an institutional perspective.

From the oppressive social atmosphere that existed in China, the shipyard managers had strong motivation to tailor their shipyards to resemble, as much as possible, the other shipyards in China, to make their shipyards isomorphic with industry throughout China. As this section points out, personal and shipyard survival was the incentive that motivated shipyard managers in this direction.

Nowhere is survival a more appropriate topic than in addressing how Chinese managers survived the purges of the Hundred Flowers Campaign, the Great Leap Forward, and the Cultural Revolution. That survival had an important influence in establishing and maintaining the control system in Chinese shipbuilding.

The Cultural Revolution (1966-1976) overlapped a large part of this period of domestic production. While it is difficult to comprehend the upheaval that this "revolution" alone caused in Chinese life, society, and organizations, this next section will try to capture the uneasiness, and even fear that existed during this period through two different examples. Next this section argues that the uneasiness extended throughout Chinese society, significantly affecting organizational behavior, including shipyard management. To avoid standing out and thus be targeted for a purge, the local shipyards all wanted to establish a control system identical to that found in the other shipyards throughout China.

The Cultural Revolution illustrates the dramatic influence the purges had on Chinese life and organizations. The first example involves a former high level management official in the Chinese oil company that replaced Shell Oil in China. Nien Cheng was the target of a random purge. The purge struck quickly.

Early one morning in mid 1966 Cheng was called to a meeting held by the Red Guards (the revolutionaries leading the Cultural Revolution). The meeting was the mock trial of a former associate. She and other former employees of the oil company watched as their associate was ridiculed, accused, and condemned. The associate was finally made to admit his crimes and express his regret. When the trial ended Cheng was warned to also reform her life.

After that meeting, Cheng's life gradually began to fall apart. First she witnessed beatings in the street, then the Red Guards ransacked her house, destroying anything of value. She was placed under house arrest, imprisoned, and her daughter was beaten to death. Finally, Cheng had her own "trial."

Cheng's trial was attended by both her former workers and the revolutionaries who had ransacked her home. The trial's leader denounced Cheng and her family as the audience shouted slogans and accusations. The revolutionaries next described her capitalistic ways, and former workers were called upon to present evidence against her. Cheng describes the experience of those witnesses.

> Former employees of Shell were called upon to give evidence against me. I could see how frightened they all were, and I wondered what they must have gone through. The men who got up to speak were white, and their hands holding the prepared statements shook. None looked in my direction (Nien Cheng, 1987, p.47).

After the accusations and evidence, Cheng attempted to speak in her defense but was only overcome by shouts and screams to confess. Cheng was also subjected to pushing, shoving, people spitting on her, and threats of death unless she confessed. When Cheng refused to confess, she was judged guilty and was sent to prison for six and one-half years (Nien Cheng, 1987, p.48).

The second case involves a design engineer formerly employed at the Shanghai shipyard. During the Cultural Revolution, W.K. Zheng was removed from his job as a design engineer and was forced to work as a laborer in one of the diesel engine shops in the shipyard. Zhang was not the only member of management to be purged in the shipyard. Most of the other educated personnel were purged as well. This included most of the engineers and management personnel employed in the shipyard. The old, educated management group was replaced by laborers who were not qualified for their jobs. For several years no design work took place and shipyard management was significantly lacking in qualified management (Zhang, 1987).

The point behind these two examples is that purges were a common occurance in Chinese life during the Cultural Revolution. They were a terror that touched all aspects of the organization, though the purges concentrated most heavily on management. As Nien Cheng points out, management was terrified that if they did not go along with the "revolution" they would be the next target. Although it may be difficult for westerners to understand, these purges had a dramatic influence on organizational behavior and control. Chinese management took strong measures to avoid attracting any special attention that would increase purge risk.

Shipyard management received the unwritten message that productivity and quality were not as important as "correct" management and strict adherence to communist revolutionary doctrine in the form of Mao Tse-tung thought. If shipyard managers could meet these two requirements, they and their shipyard seemed to have the greatest chance of avoiding a purge.

The effect the purges had on the organization was predictable. The shipyards already received most of their direction from the Sixth Ministry of Machine Building in Beijing. This had the effect of limiting the individual initiative they could apply to their jobs. The fear of being purged further quelled any new ideas, resourcefulness, and productivity increases on the part of shipyard management. Because the organization was controlled to such a degree by Beijing headquarters, shipyard management had fewer control functions to be concerned with and could devote their major effort to simply meeting their production quotas (Zhang, 1987).

As qualified shipyard management was purged and less qualified replacements took control, radical taskmasters, inclined to cheerleading, took charge. Under their influence "there was a tendency to dispense with rational planning and techniques. This resulted in larger ships being built in less time than previously; it also resulted in shoddy workmanship and produced equipment that worked poorly or was unsafe (Muller, 1983, p.179).

From the perspective of this observer, the goal of the local organization was not quality production or even a high level of productivity as much as it was to just meet the production quota set by the state. If this could be achieved, the organization (and people in that organization) seemed to stand the best chance of survival.

In this environment real control was not important. The important issue was that each shipyard be seen as a faithful organ of the Chinese state and the communist party. Shipyard management wanted to be seen as loyal followers of the communist party line. They did not want to show up as aggressive industrialists and thus attract attention that might bring a purge, but as loyal members of society who did their duty quietly for country, rallying around the popular national cause. By managing to meet these goals of loyalty in behavior, conduct, and thought, the shipyards were securing a supply of resources from the Chinese government for the shipyard. Shipyard management was acting to maintain a steady supply of resources and thus help ensure the organization's survival. But in this case, shipyard management was using the concept of legitimacy as the means to secure these resource inputs. Instead of being governed by the actual demands of production and exchange, the shipyard was motivated by the need to meet institutional rules--loyalty to communist ideology--and used those rules as a means to gain legitimacy, resources, stability, and enhanced survival prospects (Meyer and Rowan, 1977, p.341).

While the shipyard may have faced legitimacy issues during the period of domestic production, the primary focus of the industry was on establishing control over the production process. The industry's outlook, resource dependent oriented, is important because the industry, embodied by the CSSC bureaucracy, had the major input in effecting any control system change. By contrast, each shipyard had little say in determining the shipbuilding control process (Lauriat, 1983 and Muller, 1983).

The industry's orientation towards keeping control centralized is highlighted by comparing the control systems of the Soviet influence and domestic production periods. In both cases the state controlled the enterprise. In both periods the control

system centered around using organizational elements of control to secure a stable supply of production inputs, thus ensuring the organization's survival. The only difference was in who ran the control system and who supplied the resources of production.

The rest of this chapter will focus on the industry instead of individual shipyards because the paper is most interested in the principal force behind the control system change. Attention is given to the major changes the shipbuilding industry instituted. These changes included major elements of control that had not existed in China before:

- classification societies,
- a factory director responsibility system, and
- joint ventures.

The changes also included a new look at old, but largely untried ideas:

- quality control,
- the use of standards,
- a new approach to education,
- incentives, and
- marketing.

In the period of export production, we see the first signs of the shift of real organizational control from the state to the local shipyard level.

E. THE PERIOD OF EXPORT PRODUCTION

The period of export production can be subdivided into two time segments, 1981-1985 and 1986-present. The segment 1981-1985 is characterized by China's initial export sales and the control system changes that were effected to support those sales. The second segment, 1986-present, can be characterized by a new emphasis on developing more efficient shipbuilding operations.

Any discussion of the period of export production best begins with a discussion of the goal shift that brought China into the ship export market and the motivation behind that goal shift. Next, this section discusses each of the two time segments separately, highlighting the changing industry focus. An understanding of how the institutional and resource dependency perspectives apply to the organization is achieved by concentrating on a select few control system changes that occurred in each segment.

1. China Changing Focus

The goal of the Chinese economy and, more specifically, Chinese shipbuilding throughout the period of domestic production (1960-1980) was to develop self-sufficiency and independence (Yuan-Li, 1973, pp.606-607). Never again did China want to be caught in the dependent position of having to rely on another country for production inputs as it relied on the Soviet Union in the period of Soviet influence. This goal, however, led to a problem. China's isolation from the developed world and the purges that occurred in China's educational system during the Cultural Revolution caused her to lag significantly behind the rest of the world in technological capability (Bunch, 1987a and Yuan-Li, 1973). This situation was true in shipbuilding as it was throughout the industrial sector.

In the late 70's China began a program to catch up with the rest of the world technologically. The essence of the program involved acquiring foreign technology through purchase, using joint ventures, and educating Chinese at western institutions. The catch in this program was that both acquiring modern technology through import and educating Chinese engineers, educators, and managers required large sums of foreign exchange. But, foreign exchange was a scarce resource in China (Bossey, 1987 and Muller, 1983).

In shipbuilding China saw the opportunity to develop an existing industry and to generate badly needed foreign exchange (Muller, 1983). If China could sell ships in world markets, it could use the revenues generated from those sales to fund the modernization effort. "Promoting foreign trade is one of the essential conditions for modernization" (Zhao Shulian, 1986, p.k28). Former Chinese Premier Zhao Ziyang also stressed the need to increase exports to generate foreign exchange in support of the modernization: "Earning more foreign exchange by increasing exports is the key to expanding economic trade and technological exchange with foreign countries" (Zhou Shulian, p.k28).

Shipbuilding, then, was part of the answer to China's dilemma of trying to catch the rest of the world economically and technologically. Shipbuilding exports would generate the foreign exchange that China would use to buy new modern technology as well as to educate the Chinese who would be able to implement that new technology into Chinese life and the economy. But when China first tried to sell ships in world markets, she could find no buyers (Muller, 1983).

Muller points out that several reasons existed for China's initial failure to attract buyers.

> Chinese ships were 10 to 15 percent cheaper than comparable ships built in other countries but were marked by unsophisticated technology, obsolete engines, and other equipment, and they lacked standardization between units of a class. Ships built for export had to meet agreed standards for international certification, yet China had never participated in certification conventions (Muller, 1983, p.183).

China had to overcome these obstacles to attract the steady stream of ship buyers necessary to participate freely in the international market. Or, in other words, China had to convince the international market that she was a competent, reliable shipbuilder.

The control systems in place during the periods of Soviet influence and domestic production placed most of their emphasis on developing strong organizational and financial control elements. The least developed control elements were in the area of quality control and productivity.

The year 1981 brought a series of major control system changes to the Chinese shipbuilding structure bringing new emphasis on quality control and productivity elements. The control system changed because in deciding to compete on the world shipbuilding market, China had again redefined her organizational environment, subjecting it to different goals and new influences. China had to change her control system in that the existing system could not achieve export sales on the world market. If we look at these changes and those still being implemented today in the context of China's need to establish an organization that was viewed as credible and competent in the international market, we see that the changes can be explained from an institutional perspective of control system evolution. The motivation for so many of China's changes was simply China meeting the organizational requirements of the world market. China did not make these changes to alter or solidify any resource input to the shipbuilding process other than the buyer resource. The changes were made to fit the model prescribed by the new market environment in which she chose to compete. The institutional perspective helps to explain most of the significant developments in the period when China appeared to be seeking to establish a legitimate shipbuilding organization.

Recently, however, China's goals for shipbuilding have again seemed to change. China is beginning to stress efficiency in her ship production. China is also

placing renewed emphasis on the quality control and productivity control elements introduced during the initial years of export production. This shift in focus may signify the beginning of a new period in Chinese ship production, though it is still too soon to tell for sure. What is important is that these newest control system changes no longer fit the legitimacy perspective of control system evolution. Instead, the resource dependency perspective best explains this new development in the control system. The control system is tied to production efficiency rather than decoupled and focused toward legitimacy. A brief look at some of these recent, more subtle changes and an explanation of why these changes occurred is offered in the last part of the section.

2. Institutional Perspective

China's entry into world (non-Chinese) shipbuilding markets precipitated the shaping of China's shipbuilding organization along institutional lines. Until this point, as we have seen, the evolution of China's shipbuilding control system can be explained to a large degree by the resource dependency perspective. When one studies the Chinese management control system from 1981 to present, however, this theory begins to fall short in explaining the shape of the control system structure.

In the early 1980's China discovered that trying to sell ships on the open world market was radically different from selling ships in the internally controlled and tightly regulated domestic market. The domestic market was characterized by an almost insatiable desire for just about any ship built, as Muller points out.

> In 1980, the People's Republic of China (P.R.C.) had more than 50 ships on order from yards in Spain, West Germany, Malta, Yugoslavia, Romania, Pakistan, and Japan. {Additionally,} the purchase of foreign ships ... skyrocketed after 1976. The ratio of purchased to domestically built tonnage joining the Chinese international fleet jumped from 7 to 1 ... in 1976 to 25 to 1 by 1978. By 1980, such ratios had ceased to be meaningful as almost all tonnage joining the international Chinese-flag merchant fleet had been built overseas (Muller, 1983, p.183).

Because of the tremendous demand, quality control and productivity items like ship registration and standardization were minor issues for ships built in China for China. As long as the ship could float and had some reasonable means of propulsion, there was a customer for that ship on the domestic market. In the world market the situation was much different.

When China moved to begin exporting ships, it moved into a glutted world market filled with fierce competition from the most efficient, experienced,

technologically advanced shipbuilders in the world: Japan, South Korea, Taiwan, the United States, Europe, and other smaller countries. To compete in this environment, the Chinese had to restructure their management control system by conforming to the established rules of this market. China had to establish itself as a legitimate builder of ships. Market competition was the force that catalyzed the change in Chinese shipyard management control. The alternative for China not to make this change was to not sell ships in the open market.

The market environment that China faced when she reached the decision to begin exporting ships represents a radical change for the shipyards from that which they encountered when they only had to fill domestic orders. For each exporting shipyard the rules had changed. No longer were they simply competing with other government controlled and subsidized domestic organizations for scarce resources, they were also opening themselves for acceptance and inspection by the world new-ship market. They had to conform to the expectations of this market by evaluating the quality of their ships as the rest of the world evaluated them.

The rest of the world evaluated shipbuilding capability largely on the strength of quality control and productivity control elements (Bunch, 1987a). Prior to 1981, the Chinese were extremely weak in these areas. Missing were such essential elements as standardization, quality control and quality assurance, management training, and the use and acceptance of international ship registry.

The institutional perspective would predict that the gap between China and the west in these control areas might be seen by China as an obstacle to entering the world shipbuilding market. China's expectation might be that legitimacy was a prerequisite to selling ships on the world market and those control elements were necessary to establish legitimacy. The fact that China was unsuccessful in her initial attempts to enter the market (Muller, 1983) would tend to reinforce China's perception of the international legitimacy requirement for the world shipbuilding market.

The institutional perspective would also predict that if this scenario were accurate, China would move rapidly to establish market legitimacy by instituting the required control system changes. In 1981 China began to establish or restructure control in standardization, quality control, management training, and the use and acceptance of international ship registry.

The fact that these control system changes occurred when China was changing her shipbuilding environment to the world market and the goals of her industry to

becoming a producer on that market is the biggest indication that China altered her organizational structure to become more acceptable or to appear more legitimate in world shipbuilding circles. A few major changes in China's control system are now examined to see how well the institutional perspective can explain the changes.

a. International Registry of Chinese Built Ships

Before 1981 and the start of Chinese ship exportation, no international ship registry organization inspected or certified Chinese ships. China did not allow such inspections because for domestic shipping companies there just was no motivation to allow the inspection.

For ship export, however, ship certification is mandatory. Without it western insurers like Lloyds will not insure the hull. Since ships do represent a major capital expenditure, few private owners can afford to lose any one or more of their ships. Insurance is necessary. Obviously, a shipowner will not buy a ship if the ship cannot be insured. Without an insurer willing to carry the hull, the risk to shipping companies and ship owners is just too great.

To insure a ship the insurer must have guarantees that carrying that ship is a reasonable risk. They want to ensure that the ship is seaworthy for the conditions for which it was designed. The criteria for insurance is ship registry. The ship can be registered if it passes all required inspections and if construction and materials going into the ship meet the minimum standards of the registry organization.

When China first entered the export market she found that no one would buy her ships because no one would insure them for the new owners. The only solution was to meet the institutional demands of the world market. In the early 1980's China began opening her shipyards to international registry organizations. Additionally, China formed her own registry organization patterned after these other organizations. The results were dramatic. Not only did this help make China produced ships acceptable, and, more importantly, saleable, but these registry organizations helped bring improvements to the way the Chinese shipyards were run. They forced Chinese shipbuilding to employ the technology, construction techniques, and management practices that helped make China more efficient in her ship production. And this improved efficiency helped make China more competitive in her new market. But regardless of the extra dividends registry brought, the Chinese initially opened their shipyards to these practices to gain legitimacy in the market.

b. Quality Control

One offshoot of ship certification was the emphasis placed on quality control. As mentioned above, the inspectors from the registry organizations set up offices in Chinese shipyards so they could monitor the construction of the vessels they were certifying. From these offices came a wealth of education, training, and significant suggestions for improving day to day operations in the shipyards. *Business China* explains the role these classification societies play.

> According to the CSSC, more then 90% of ships being built in China for export are surveyed and classified by LR (Lloyd's Register of Shipping). LR surveyors stationed in Dalian, Shanghai, and Guangzhou have played a positive role ... in helping to familiarize CSSC with prevailing rules and regulations on shipbuilding and to improve the quality of products. LR's approval of some marine equipment and steels produced in China has paved the way for their export ("China Industry," 1983).

Prior to opening her doors to western expertise, China lacked any sort of real quality control or quality assurance program. This deficiency showed up dramatically in shipyard goods that China's industrial plant produced. In many ways the products were seriously deficient or lacking. This was true from the ships themselves to the steel that China would used to build the ships (Smith, 1987 and Zhang, 1987). One example involved the new cargo ship Fengqing first mentioned in chapter IV. As noted, the Ministry of Communications was so much in doubt about the mechanical reliability of the new ship that it was considered unwise to put the ship into long-distance international service (Muller, 1983, p.180). As for steel production, Zhang points out that a major problem with Chinese steel production was that the mills just could not consistently produce batches of quality steel (Zhang, 1987). Many of these problems could have been solved with an improved quality control program in Chinese shipyards, but under the old control system in effect during domestic production no incentive existed to do so ("Economic," 1986). The only factor that mattered was production. As long as the required number of ships was built, the government would find a domestic buyer for that ship. China's internal demand for ships was just too great (Muller, 1983, p.179).

The move to export changed the Chinese shipbuilding organization's approach toward quality control. In the world market, successful shipbuilders all had quality control programs. As part of ship certification, all critical steel used in hull

construction had to be produced from a steel making operation that had a working quality control program. Since China had no quality control program in her steel making operation, she had to import all critical steel for her export ships. Most of this steel came from Japan (Smith, 1987 and Zhang, 1987). The expectations of her environment forced China to change the orientation of her control system. Not only did she have to start importing steel but she also moved to establish a quality control program in her own industries as well. However, the value the Chinese place in their quality control program lies in the institutional legitimacy they see the program bringing. Having an effective quality control program is not necessary; it is only necessary that a structure for that quality control program exist.

Further evidence exists that China brought quality control into the shipyard principally to legitimize the industry. Smith (1987) says that for a quality control program to work, the top organizational executives must give that program heavy emphasis. Top level management must demand quality. According to Smith, this did not happen in Chinese shipyards. Although the quality control department in a Chinese shipyard reported directly to the chief engineer, the chief engineer and shipyard director did not demand enough from that department. Instead, the quality control program seemed to be more of a program to satisfy the demands of buyers on the international market. Chinese management did not give quality control the required emphasis needed to make their program effective (Smith, 1987).

c. Standardization

Standardization in shipbuilding exists largely because of three influences. The first is the role played by classification societies. Classification societies need objective criteria against which to evaluate the ships they are certifying. For each type of vessel, the classification society establishes certain standards of materials, design, and construction that the ship must be built to (Muller, 1983, p.183). The second influence on standardization is the buyer. The buyer wants a ship built to certain minimum specifications. Additionally, the buyer will want certain minimum features built into the ship. This may include material, design or construction specifications. This demand also contributes to standards in that it helps establish a minimum level of construction. The third motivating force behind standardization in shipbuilding is the builder.

A motivating factor behind standardization was the need to demonstrate competence to foreign buyers. The shipyards had to standardize the production

process to appear legitimate to attract foreign buyers. Having a standardized production process made the Chinese shipyards much more credible to foreign buyers, and the Chinese realized this (Muller, 1983, p.183). In this regard bringing standardization to Chinese shipyards was inspired more by the concern to be a legitimate organization than by any need to improve the efficiency (Meyer and Rowan, 1977).

However, though the initial motivation for the institution of standardization was legitimacy, standardization in shipbuilding brings efficiency to the production process. This point is emphasized by Cheng Tianzhu:

> Standardization work plays an important role in strengthening management of enterprises, improving quality of output, shortening organizing and consolidation of specialized production, and in coordinating overall relationships. It promotes the growth of the shipbuilding industry and provides a fairly good foundation for the further development of our national shipbuilding industry (Cheng Tianzhu, 1979).

Standardization is a control element that helps improve quality and increase productivity. Before the period of export production nothing in the environment demanded this improvement. Classification societies did not yet exist in China. Buyers had little say in how their ship was built since all ship orders went through the ministerial level in Beijing, circumventing any direct negotiation between buyer and seller (Zheng, 1987). Finally, since the organization did not retain any profits of operation and all resources were supplied by the state (Farrell, 1987, Smith, 1987, and Zhang, 1987), efficiency was not a concern for the shipyards.

Export brought in classification societies and foreign buyers. Later came the added incentive that the more efficiently the shipyard could build a ship, the larger the return in foreign exchange the organization would realize from the ship sale.

d. Management Training

Meyer and Rowan tell us that "economic markets place a premium on rationality and coordination. As markets expand, the related networks in a given domain become more complex and differentiated and organizations in that domain must manage more internal and boundary spanning interdependencies" (Meyer and Rowan, 1977, p.342). This argument can be used to show that management training in Chinese shipyards has institutional validity.

In exporting China found herself moving into a faster expanding, more complex market than domestic production provided. China entered a market where, according to Meyer and Rowan, a premium is placed on rationality and coordination. Education and management training were devices that China could use to improve its industry's "rationality and coordination."

In terms of the market, management can be thought of as the personality of an organization and the motivating force directing that organization. Better educated or trained managers are better able to understand the forces at work in, and the demands of, a complex market. If managers better understand the forces they are working with, they can make more informed decisions and better coordinate their organization's activities with the demands of the market. Improved coordination leads to the market perception of a more rational organization, one that acts instead of reacts.

Since entering the world shipbuilding market, China has made a major commitment to improving the level of shipyard management training (Bunch, 1987d and Smith, 1987). The intensity of management training has been increased in the following ways:

- An increased number of shipyard managers, design personnel and engineers have been sent abroad for training.
- An increased number of western shipbuilding, management, and technical experts have been brought to the Chinese shipyards and marine institutes to teach and train Chinese management.
- The number of Chinese management students enrolled in Chinese universities and technical institutes is at an all time high.

All successful shipbuilding industries give heavy emphasis to management training (Bunch, 1987d).

However, in many ways the shipyard managers had little opportunity to exercise their new management expertise. The reason for this was the strict control over shipbuilding that the CSSC exercised in Beijing. Until recently, shipbuilding headquarters controlled most major shipyard operations, including funding, planning, marketing, and key personnel assignments (Bunch, 1987c and "China Industry," 1983). But because so much shipyard control was held in Beijing, the shipyard managers had very little opportunity to utilize the new management training they had received. Shipyard managers had only a limited say over shipyard operations. Thus, early in the period of export production, the principal value of the increased education of shipyard

managers and exposure to Western shipbuilding practices lay in creating an air of knowledge, professional competency, and organizational legitimacy. The increased competency of China's shipyard managers did not help improve the efficiency of operations or the quality of product, it just made China look like a more capable shipbuilder.

e. Joint Ventures

Joint ventures provided China with an operational capability that may not have existed before or may have been undeveloped. In terms of institutional theory joint ventures provided a quick, inexpensive way to close the gap between China and the established market, both in terms of technology and structure. In a joint venture the operation took the name of the established firm, and since that firm both set-up and managed operations, China realized an increase in credibility in an area where it may have been previously deficient.

An example of this is the case of Chinese marine motors. In the past China has had problems producing dependable marine motors, both electric and diesel powered (Bunch, 1987a, Smith, 1987, Zhang, 1987, and "Shipbuilding in China," 1985, p.99). Now, however, through joint ventures with a variety of Japanese and western firms ("Overseas Links," 1984), Chinese yards are seen as a competent manufacturer in this area ("Overseas Links," 1984 and "Shipbuilding in China," 1985). Though this competency is highly dependent on the foreign partner's contribution to the enterprise, Chinese industry benefits from the association.

f. License

One advantage with license agreements is that, like joint ventures, it helps China establish a credibility that did not previously exist. An example is China's experience producing marine diesel engines. In the period of domestic production China's shipbuilding capacity was limited by her ability to produce engines large enough and dependable enough to power vessels on worldwide voyages (Muller, 1983, p.118). Now, however, China exports marine diesels, producing European MAN-B&W, Sulzer, and SEMT-Pielstick engines in Chinese shipyards under licensing agreements ("Overseas Links," 1984). The licensor's established product has helped significantly improve China's reputation in the production area (*Lloyd's List*, 1987).

Using control system techniques like license and joint ventures, China is building its credibility as a shipbuilder. "China's intention is to show the outside world that it is capable of building in competition with other Far Eastern yards, principally in Japan and S. Korea" ("Shipbuilding in China," 1985, p.99).

g. Conclusion

From the pressures of a new environment created by China's entry into the world shipbuilding market, we see China's shipyard management control system undergoing significant change. In working to achieve effectiveness, the shipbuilding industry added to and revised control structures relating to productivity and quality control. Yet, while the shape and structure of the organization was changing significantly, her actual way of doing business changed little.

3. **1980-Present: A Shift Back to Resource Dependency?**

Institutional theory helps explain the major changes China made in the shipbuilding control system once she entered the export market. Yet, institutional theory does not explain all the changes in the control system, especially recent changes in that system.

At the beginning of export production, China added control system structure to match that found at western shipyards. As noted, controls like quality control and standardization were added without giving those controls the attention necessary to make them work (Smith, 1987). These control system changes were made independent of the immediate efficacy of the control. The controls were part of the decoupling process which separated production from the control structure. Quality control (discussed in chapter III) had an established structure, yet had little affect on daily production activities. Because of this apparent lack of emphasis on instituting effective controls (1981-1985), the intent of the industry seemed to be to build the organizational structure necessary to fit China into a niche in the world market.

In the past several years China has seemed to grant more autonomy to the local shipyards and to give the local shipyard directors more of a free hand in managing their enterprises. Increased autonomy has come through control system innovations like the factory director responsibility system, increased incentives for shipyard workers, new sources of financing for the shipyards, a greater marketing effort by each individual shipyard, and increased shipyard participation in the education and training of her workforce. These and other reforms, which indicate a start in the shifting of local shipyard control to the shipyard, are not as easily explained by institutional theory.

Now, however, one sees an increased emphasis on efficiency in the shipyard and new experiments in shipyard management in attempts to achieve efficiency gains. China has been giving increased attention to building a control system specially suited

to address the problems found in the Chinese shipyard. Progress in areas like education, incentives, and quality control is proof that the evolving shipyard control system is now one founded on the demands of technical production and exchange (Meyer and Rowan, 1977). No longer are control system changes made independent of the immediate efficacy of the control. Instead, the implications each control has on the organization is considered before that control is adopted (Meyer and Rowan, 1977).

The factory director responsibility system is the best indication of this phenomenon. Under this new incentive plan, factory directors are strongly concerned with their immediate output and thus act to establish more control over their organization ("New Rules," 1977).

Just about all of the latest reforms have come in the area of quality control and productivity. Areas addressed include incentives, joint venture and license, education and training, quality control, and standards. Each of these areas of control system change will be discussed in this section. The above list is only meant to be representative of trends that are occuring in Chinese shipyard control.

China seems to be looking for new and innovative ways to improve her performance as a world shipbuilder. Besides the new controls just mentioned, local management has been given the increased authority needed to make the most effective use of these controls. These recent changes may mark the beginning of a new period in Chinese shipbuilding, a period of efficient production. However, it is still too early to tell for sure.

If China's initial shipyard goal (in the period of export production) was simply to be able to sell ships on the world market, then that goal has long ago been realized. China is now a viable force in the competition for export sales with approximately one-fifth total ship production being exported and total tonnage exceeding 100,000 dwt each year (*Lloyd's List*, 1986-1987). These figures do not indicate that China is an efficient shipbuilder or that China builds high quality ships. They do say that China has achieved a basic level of competence where she can compete for new orders with other shipbuilding nations (*Lloyd's List*, 1986-1987).

Now, however, to become more competitive, to keep costs down, and improve the profits realized by her operations, Chinese shipbuilding must become more efficient. If China can improve the efficiency of her operation, she will improve the foreign exchange return she realizes from her operations.

Besides concern for efficiency and the desire to increase foreign exchange earnings from ship sales, corporate memory has also had an impact in changing the direction of control system changes during the period of export production. It, too, has been an influence in shifting shipbuilding focus from form and structure to efficiency and high productivity operations. Though not previously mentioned in this paper, corporate memory is illustrative of the assimilation process that the shipyard organization is experiencing. This assimilation process plays an important role in control system evolution.

Two facts support this position. First, China's shipyard knowledge base of western control structure is much larger than it was eight years ago. Many Chinese managers have now been trained in the idea of efficient, quality production and introduced to the possibilities offered by quality control and productivity control elements. Second, Chinese managers are just starting to learn how to utilize quality control and productivity control structures. While many of these controls were created to meet institutional concerns seven years ago, the managers are just starting to see what it takes to make these controls effective and useful. This section will use the resource dependency perspective to show how Chinese shipbuilding has changed from an organization in search of legitimacy to possibly one most concerned with efficiency and maximizing the return from her operations.

a. Efficiency Concerns

By the early 1980's China had become a ship exporter (Muller, 1983, p.183). Still, the foreign exchange that was being generated by these exports was being limited by the large percentage of ship components and steel that had to be imported to meet buyer and classification society standards ("China Industry," 30 March 1983, p.48). If China could decrease her reliance on such imports and increase the domestic capability to outfit the ships, then China would realize more of a profit from her ship sales. The means to reduce her reliance on imported ship components was to improve the quality control of her component and steel manufacturers and improve the standards of manufacture of these components. Improvement in the quality of domestic components could be achieved through such measures as using joint ventures to bring in improved manufacturing techniques, licensing agreements to bring in proven, well engineered designs, and using worker and management incentives to improve the efficiency, quality, and output of the shipyards. In the past few years China seems to have been moving more aggressively in these areas. Once efficiency was not an issue, now it is fast becoming one ("Economic Commission," 1986, p.k33).

b. Joint Venture and License

While both joint venture and production under licensing agreements help give Chinese shipbuilding legitimacy in the world market, we must keep in mind that the incentive behind China's drive to export is to create the foreign exchange earnings that can be used to buy technology and education.

Both joint ventures and licensing agreements bring foreign expertise, technology, and proven methods to China, and they do so with a minimum capital expenditure. Joint ventures and license agreements also allow China to make maximum use of its cheap labor supply, while still making use of the advanced technology and engineering expertise available in more advanced countries ("China and Singapore," 1981). Or, in other words, both joint ventures and licensing help improve the efficiency of Chinese manufacturing. These two aspects of the control system have probably helped modernize Chinese industry more that any other input. Evidence of this includes expansion of China's production ability into new areas like marine diesels, electric motors, turbochargers, generators, gearboxes, and other areas mentioned in chapter III, as well as the improvement in quality in production areas that China was already active in (Bunch, 1987d, *Lloyd's List*, 1987, and Smith, 1987).

The modernization of the shipbuilding industry reflects positively on the control the shipyards have over their exchange relationships. By improving the quality of their marine products and by expanding their production capabilities, the market is faced with a more versatile, more capable China that is better equipped to compete on an equal level with other shipbuilding nations. Not only has the variety of products that Chinese shipyards can offer expanded, thus increasing sales opportunities, but also the improvement in quality, or the buyer's perception of a quality improvement, has enabled Chinese shipbuilding to acquire more buyers.

c. Incentives

New ventures into providing material incentives for shipyard workers and management is representative of a new perspective of Chinese shipyard control. An understanding of this idea is facilitated by some knowledge of the past history and philosophy of incentives in China.

Until the early 1980's no effort was made to try and improve the productivity of shipyard workers through incentives. The only incentive that existed for industrial workers was the motivation of loyalty to the party and state, but this was not always an effective incentive. Since everyone was expected to do the utmost

(Fairbank, Reischauer, and Craig, 1978, pp.919-920), material incentives were just not considered necessary.

The lack of an incentive system hurt China. Without material incentives for management or the individual worker, both productivity and the quality of shipyard products suffered. Dr. Boris Butman, a former Soviet shipbuilding engineer, says that in a socialist environment, as exists in the communist countries, productivity and quality will always be a problem. In fact, Dr. Butman says,

> the more socialist principles are employed the more {productivity and} quality will decrease. {Productivity and} quality depend on the interest of the worker, and the worker's interest will be a function of the incentive he has to do the job. In socialist countries employees do not have any incentive to do a good job. In countries like China and the Soviet Union the employees have a guaranteed job with a set wage. So no incentive exists to do a good job (Butman, 1987).

As long as China did not export, low shipyard productivity was not a recognizable problem. Industrial inefficiency was hidden by doctored production figures and quotas that were set artificially low (Choh, 1962 and Barnett, 1974). Production inefficiencies were written off to unexplainable, unavoidable problems such as delays of materials, a shortage of trained, high skill workers, the weakness of the economy, and the history of failures the Chinese government had already experienced (Barnett, 1974 and Jones, 1980).

This situation could exist because the shipyards had no competition. They produced a strategic good for an insatiable market. Because of greater social and political problems, no one noticed if they were inefficient producers as long as they were producers. In this environment material incentives designed to increase productivity were not an important consideration.

Initially in the period of export production the situation did not significantly change. In the early 1980's the Chinese were concerned with simple effectiveness. Efficiency was not an issue and the shipyards were willing to pour unlimited quantities of resources into the production process (Bunch, 1987d). During this period they did not worry about controlling through incentives.

In the last two years shipyard goals have changed to where they are more concerned with efficiency. Since having achieved success in export, the Chinese are starting to experiment with ways to become more efficient. Shipyard management has become cognizant that they are now a minor player in the world market. To survive in

this new competitive environment, they have to become more efficient to guarantee organizational survival. One means they have taken to become more efficient is to improve productivity through incentives.

One type of incentive system with which China has experimented is profit sharing. The experiment was first tried in Dalian ("China Fights," 1987, p.15). Dalian management works under a profit goal with everything up to a certain level going to the state and everything over that quota retained by the shipyard to use as it sees fit. Dalian management has considerably more say over how its shipyard is run than do other non-profit oriented CSSC shipyards. That includes how much it pays its workers. Dalian now has the freedom to return profit sharing funds to its workers to further motivate productivity and quality oriented behavior ("China Fights," 1987).

The Dalian experiment is being applied to more and more shipyards (Bunch, 1987d). Now that the local shipyards have more control over their operations, they too are experimenting in ways to improve worker performance. Having the extra profit sharing funds gives the shipyards a tool to further motivate workers and not just through wage increases. Increases in productivity can be motivated and achieved through improved training and increased social benefits as well. These incentives are being tried in all Chinese shipyards.

The resource dependency perspective explains the use of incentives in the following manner. Incentives increase the control management has over its organization while the organization's discretion and capability to take desired action is directly related to the extent the organization can control and motivate behavior (Pfeffer and Salancik, 1978, p.260). Thus incentives increase the ability of the organization to take desired action.

The shipyard workers can be viewed as actors in the organization who are in a position to contribute a variable level of effort that influences the actions of the organization (Pfeffer and Salancik, 1978). The organization is motivated to control this influence, and a major means of control is achieved through incentives. The more control the organization achieves, the more the organization can influence efficient operations. And increased efficiency and maximized resource utilization increases the stability of the shipyard (Pfeffer and Salancik, 1978).

d. Factory Director Responsibility System

In the last several years China has been making significant moves to give factory/shipyard management full control over their organization. In January 1987

"Chinese central authorities promulgated three sets of new regulations to promote the system of factory directors assuming full responsibility for production and management" ("New Rules," 1987, p.1). The three new regulations, along with other recent changes in Chinese management are "designed to shift Chinese management from the old director responsibility system under the leadership of the party committee {a centralized set-up} to the new system of making directors fully responsible for production and management" ("New Rules," 1987, p.1), a much more decentralized organizational structure.

This shift in control to the local level gave the factory director more decision making authority and thus improved the operation of the plants. Areas where directors would have more say include operation, production, and trade unions. All of this signifies a new focus for Chinese industry. Efficiency and holding local management responsible for performance are now key issues.

Efficiency and local management responsibility are both important resource dependency oriented ideas (Pfeffer and Salancik, 1978). Both concepts task shipyard management with conscious concern for resource maximization and organizational stability. They stress organizational performance and emphasize the health of the organization.

Efficiency is important because improved efficiency will help reduce the organization's dependence on resource exchanges with external agents. If the organization can reduce these resource exchanges, its dependence on the organization is reduced and more control over the organization shifts back to it. The organization becomes less resource dependent on its environment and the agents in that environment (Pfeffer and Salancik, 1978, p.109).

With the new orientation of managing the shipyards as profit centers, however, the new regulations also emphasize the role of workers' congresses and other forms of democratic management. So, although the organization's management is given more latitude, the party seems to be leaving the door open to retake firm control should attitudes or circumstances change.

e. Management Training

An important concept in the resource dependency perspective is that the survivability of the organization is always in question, that the organization is constantly motivated by a concern for the continued existence of the venture. Organizational survival is achieved by actively and directly confronting the problem of

acquiring resources. Organizations that are resource dependent will seek stability and certainty in their resource exchanges. One important resource exchange is the training of workers and management.

Trained workers are a resource in that their training leads to improved productivity for the organization. Organization sponsored training is an exchange in that workers and management are given new skills and knowledge in return for the improved performance level of those workers after they are trained.

The Chinese have recently taken very strong steps to improve the vitality of their shipbuilding industry by placing heavy emphasis on education and training, including management training. Given the increasing emphasis on decision-making at the shipyard level, emphasis on management training indicates a vision for the long term health of the organization by ensuring a long term source of a vital resource--skilled, knowledgeable managers.

The Chinese focus a great deal of their management training around western expertise. Evidence exists to show that the Chinese are opening their doors to western management training at every opportunity. The Chinese have established formal joint educational programs with several western universities, including the University of California at Berkeley, Stanford, the University of Houston, and others. In these joint programs China provides the students and the western university provides the professors (Smith, 1987).

The Chinese also encourage experienced western executives to share their knowledge. In 1983 Mr. Phillip Smith, the retired chief executive officer of Smith, Yuill, and Company (a U.S. steel manufacturer) went to China to give a series of strategic planning lectures to Chinese steel executives. In 1985 and 1986 he also served as Dean of the Senior Executive Program at the Dalian Institute of Technology (the national center for industrial, scientific, and technology management development) (Smith, 1987).

Mr. Smith's experience is not unique. The Chinese actively seek out these western experts to garner their knowledge. Chinese students studying abroad at western universities actively recruit their professors to come to China for seminars, lecture series, and to pursue special projects. Professor Howard Bunch from the University of Michigan's Transportation Research Institute has been involved in two such educational ventures (Bunch, 1987a and Smith, 1987).

This search for knowledge by the Chinese is important because it provides a base of capable management to continue to develop Chinese shipyards and other industries, a pool that can then pass its knowledge to other Chinese. The western emphasis helps elevate Chinese shipbuilding to the advanced levels found in the west and to accomplish this more quickly than by working alone. And lastly, by training managers the organization creates the ability "to direct the organization to more favorable environments and to managing and establish negotiated environments favorable to the organization" (Pfeffer and Salancik, 1978, p.263).

f. Quality Control

At the start of the export period China gave substantial attention to implementing quality control structure, but she directed little effort to actually making quality control work. In the past several years indications are that that may be changing. Top level management is now giving quality control the attention it must have to work (Smith, 1987). This attention is demonstrated by Deng Xioping. "In the past, we only stressed output value and quantity instead of quality" ("Economic Commission," 1986, p.k-33). Where China had paid lip service to quality control making it no special priority, suddenly, the top leaders of the Communist party and state government are now making quality control a national issue ("Economic Commission," 1986).

This concern for quality highlights the shift in focus that Chinese industry, including shipbuilding, has recently made. Quality now has real meaning. While few real changes in the quality control program have occured yet, the most important change is evidenced. And that is top level commitment to quality. If China is to be consistent in this area, we should expect to see more and more quality control emphasis in Chinese shipyards. Efficiency and profit maximization is the direction in which industrial management is now focusing, and quality control is now an important part.

g. Standards

The problem with standards is they are useless if not used. The Chinese long realized that if they were effective in making standardization part of their shipbuilding operation, the efficiency of that operation would improve (Chang Tsung, 1979). Despite this recognition, as chapter 3 points out, the Chinese have experienced great difficulty in implementing a standardization program. Increased competition and new incentives for local shipyard management through the [illegible]

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responsibility program and profit sharing-- may be solving the implementation problem. It certainly has given standardization new meaning for shipyard management. In directing the positive efforts of standardization back to the shipyard, the control system changes have refocused management attention on established but non-working control system elements like quality control and standardization.

Foreign input taught shipyard managers that standardization would help reduce the cost of their operations (Muller, 1983, p.184). If the cost of operations were reduced, then the shipyard would realize greater profits from the sale of each ship, with partial retention of those profits by the local shipyard. For the first time shipyard management had the incentive to work to maximize foreign exchange earnings. For the first time shipyard management had the incentive to put the effort into making standardization work.

These incentives seem to be having a positive effect. High level shipyard management is now focusing more attention on implementing existing standardization and expanding those programs as well (Bunch, 1987d and Smith, 1987). Shipyard management is giving more support to making shipyard standardization a high priority item ("Economic Commission," 1986).

h. Conclusion

China's need for foreign currency is what initially motivated her to enter the export market as well as to seek legitimacy in that market. Foreign exchange was needed for China to import the technology and educational resources necessary to improve her industrial base and move most rapidly into competitive status with other nations; China's cheap inexhaustable labor supply was inefficient alone to change China into an industrial power.

Initially, just selling ships abroad and earning foreign exchange was enough, regardless of how many resources had to go into the production process (Bunch, 1987d). China has come to realize, however, that the more efficiently she can produce ships, the larger the return or profit from the sale of each ship. This realization has helped prompt further control system changes like the factory director responsibility system, joint ventures, and other moves to help provide incentives and means for local shipyard management to run their shipyards more efficiently. China realizes that the resources she puts into shipbuilding can bring a better return.

This realization is playing a major role in implementing China's most recent control system changes, changes that follow a resource dependency perspective. As the

shipbuilding industry's focus shifts, the organization is beginning to realize that being legitimate is not enough. In the competitive shipbuilding market China must also be highly efficient. China is learning that the institutionally oriented control structure put into place in the early 1980's does not have the capability of eliciting efficiency and thus changes had to be made. If China maintains this new goal of efficient ship production, we may see China enter a new period of ship production, a period where the resource dependency theory will continue to explain and predict the direction of the Chinese shipyard control system.

VI. CONCLUSION

This thesis attempts to identify the nature of the Chinese shipyard control system. The approach taken was to first define problems that the study would have to contend with, problems like cultural bias, informational shortcomings, and research restrictions. Next, a comprehensive list of control features was put together in an attempt to present the current elements in the Chinese shipyard control system. Those features showed the principal ways the Chinese shipbuilding industry was controlled and were grouped into the areas of organization, quality control and productivity, and financial control to illustrate what control areas the Chinese saw as most important.

By looking at the organization through these control elements, the goals of the organization were clarified and the tools available to shipyard managers identified. Additionally, the distribution of power throughout the organization was discussed.

From this point, a study was made of how this control system came to be. Two different perspectives were used to explain the evolution of the control system, specifically why Chinese management developed the organization as they did and how it sought to achieve organizational goals in the shipbuilding environment.

The intent of the paper is not to analyze the evolution of the control system through each control element described in Chapter II. Instead, the paper focuses on changes in major control elements to illustrate the changing focus and goals of the shipbuilding industry.

A limitation of the study is the scarcity of information relating to specific control system changes during the period of Soviet influence and the period of domestic production. Because data collection keyed on the current control system and concentrated on the years 1980 to present, any specific control system discussion prior to this period was limited by research available. Discussion of these two periods is thus limited to more general statements, fewer specific examples, and less explicit documentation. Still, the most dramatic changes in Chinese shipyard management control have occurred during the period of export production. This is the most important period of control system evolution, and research in that period is more complete. The associated discussion of specific control system changes is more complete as well.

Looking at control system evolution has shown that the way the control system evolves is very dependent on both the goals China sets for her shipbuilding organization and the environment the organization operates in. These two considerations are closely related in that in setting organizational goals, the Chinese government to a large extent selects the environment in which the shipbuilding organization will operate.

Initially, following the Chinese revolution, the goal of the Chinese government was simply to establish a shipbuilding industry. The environment the industry operated in was free of competition yet very constrained in supporting resources. Toward this goal and in this environment, a resource dependency perspective best explains the control system changes that occurred.

A resource dependency perspective continued to be applicable during the period of domestic production. In this period the Chinese had lost the guidance and support the Soviet Union had provided. The organizational goal was to establish an independent shipbuilding capability in an environment still significantly constrained by resources.

The organizational goal changed dramatically in the period of export production. For export production, the Chinese shipbuilding goal was to sell ships abroad to earn foreign exchange. This goal helped present a new environment for the organization. Now China faced international competition, though its resource inputs were less constrained. In this new setting the institutional perspective best explained the initial control system changes that occured.

Since China first entered the export market, her shipbuilding capabilities have improved dramatically. With that improvement has come a new focus on shipbuilding efficiency. China has set her sights on continued growth and development through purchased technology and new management techniques from abroad.

To best meet this end, China is motivated to generate the highest possible return from operations which generate foreign exchange (like shipbuilding). Improvements in efficiency help maximize that return. This translates into new emphasis on quality control and productivity control elements. If China can improve her control in these areas, shipbuilding efficiency should also improve.

Recent changes in China's shipbuilding control system indicate that the industry is pointing in this direction. China may be entering a new period of shipbuilding, the period of efficient production, though it is still too soon to tell for sure.

[illegible] toward increased efficiency is most consistent with a resource dependency perspective. The most recent control system changes in the past few years can best be explained from this perspective. If the goal of Chinese shipbuilding is now more efficient production and if China continues to operate in the world shipbuilding market, this author predicts that the resource dependency perspective will continue to explain new control system changes.

The Chinese shipbuilding control system is more so than ever a rapidly changing control system. The direction this industry takes into the future remains of interest. Hopefully, this study will stimulate thought on Chinese shipbuilding and the control systems that the shipbuilding organization has employed throughout its history. The study is, however, only a first look at an industry and a control system that is ripe for additional research. It is the hope of this author that further research will be conducted that will lead to an even better understanding of Chinese shipyard control.

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